Grinding and Finishing

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The Magazine Devoted Exclusively to Abrasive Operations

NOV 23 1955

★ FEATURES

Satin Finishes: Important in Polishing and Grinding Stainless

British Bicycle Makers Meet Competition with Ingenious Tooling

Interesting Cam Grinding Fixture

Media and Compounds For Precision Barrel Finishing

ALSO IN THIS ISSUE

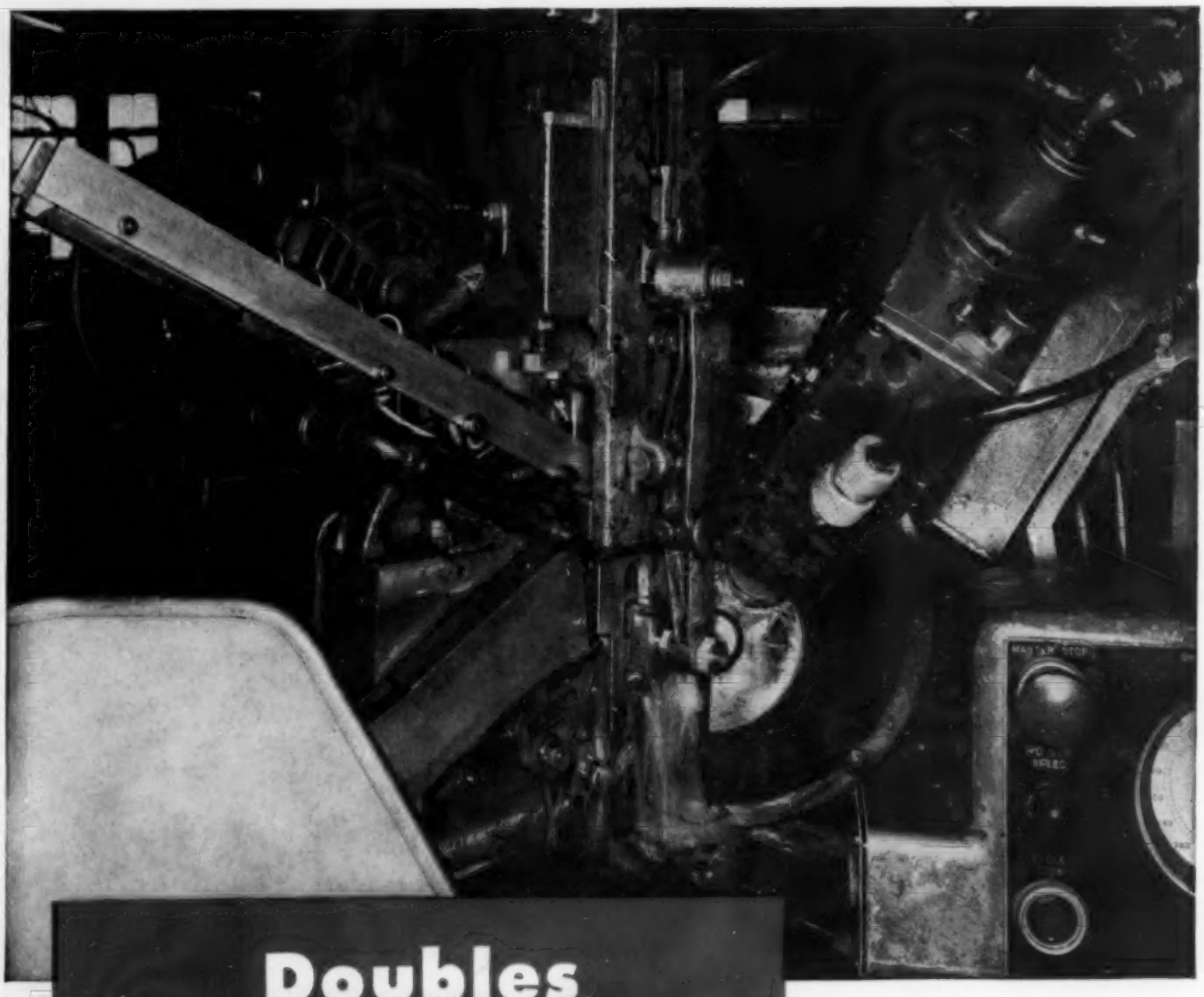
Tool and Cutter Grinding Department

Free Literature

New Equipment

Shop Hints and Kinks

November 1955



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Grinding and Finishing

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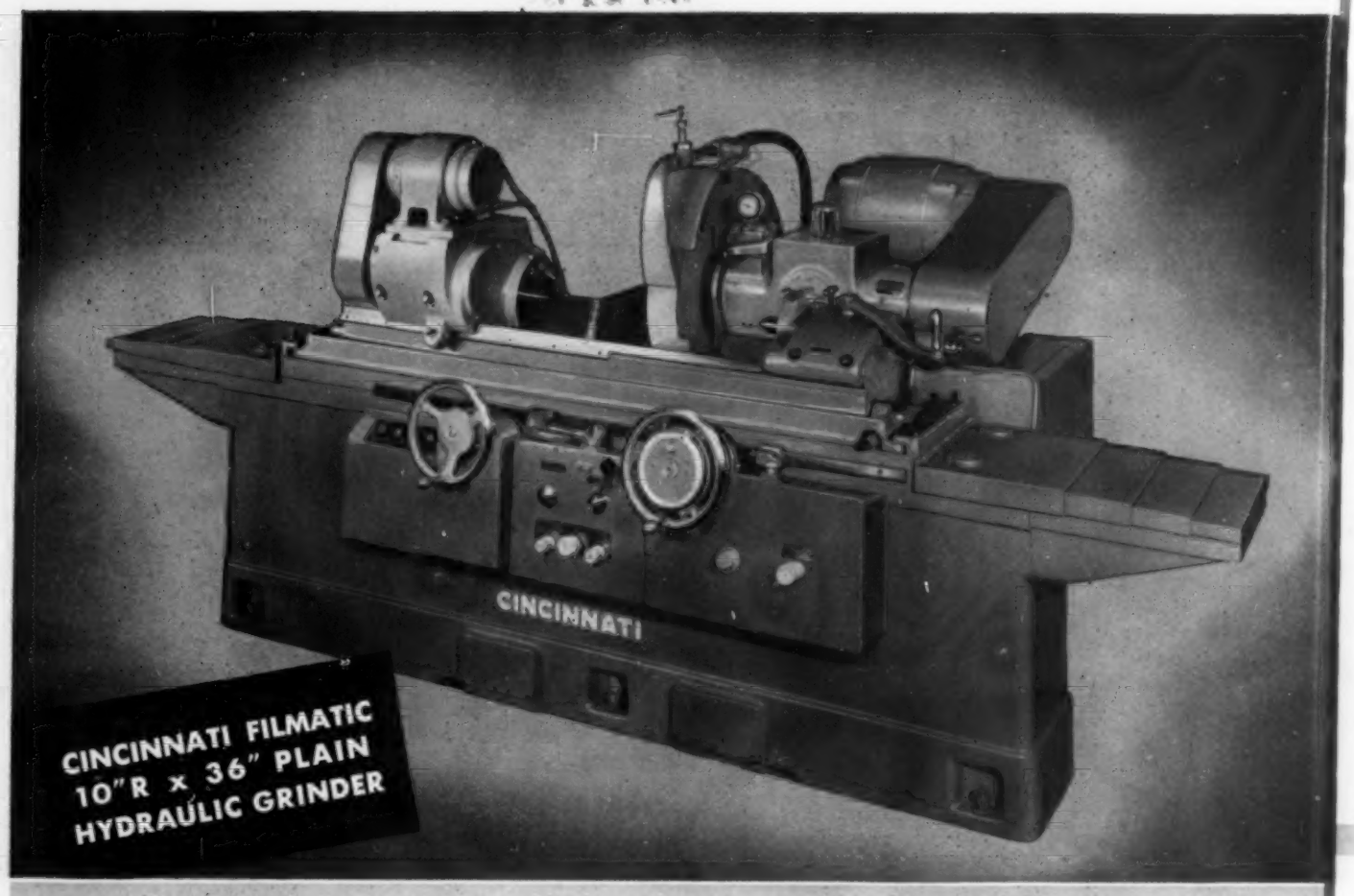

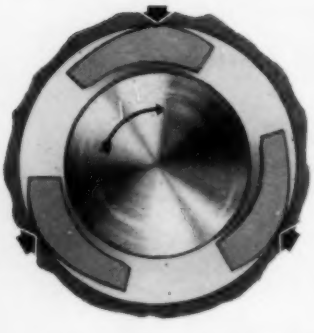

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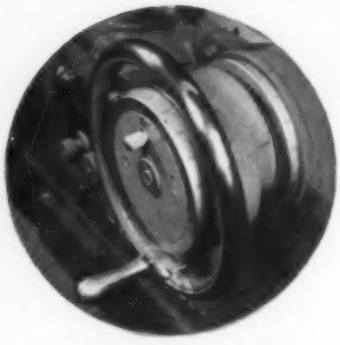

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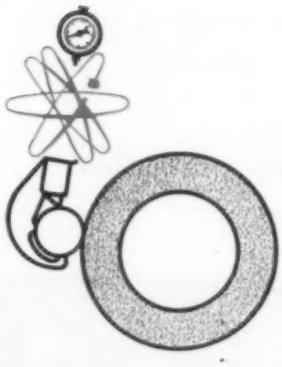

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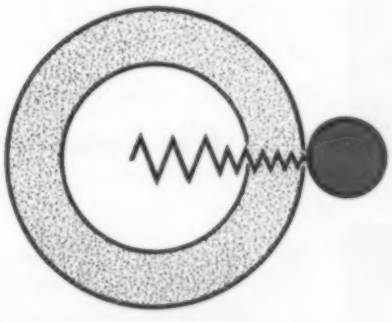

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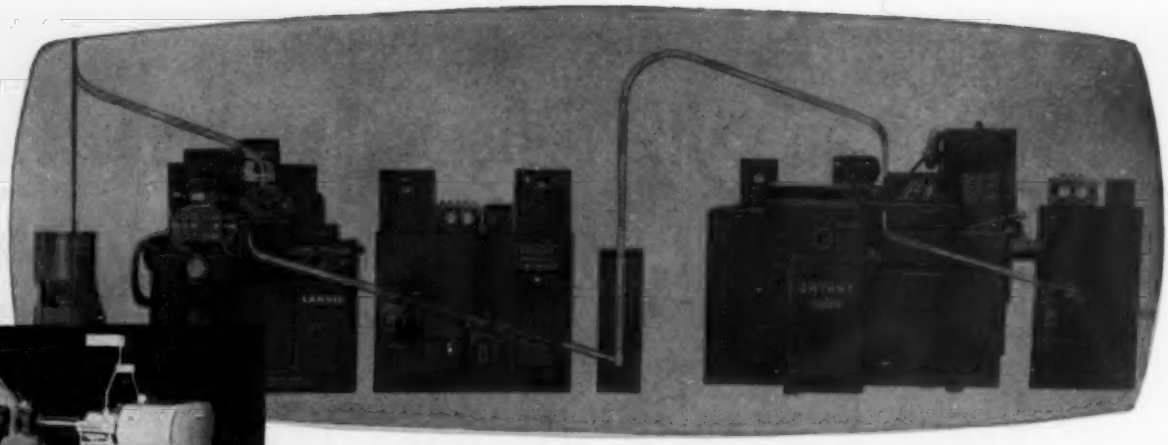

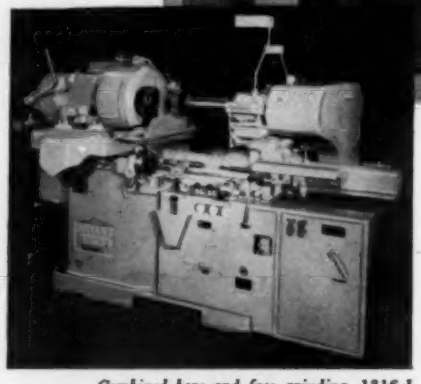

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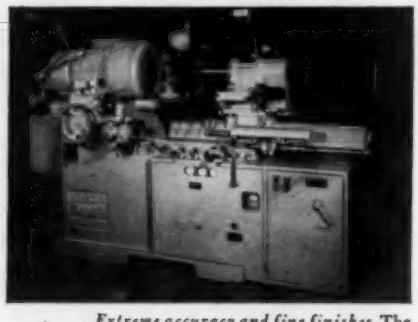

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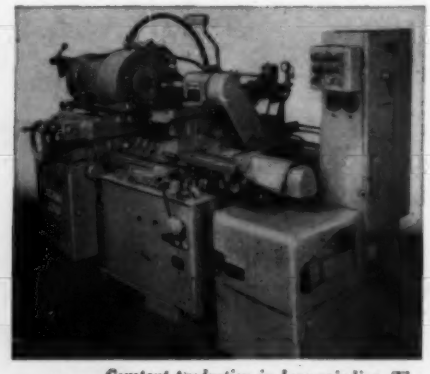

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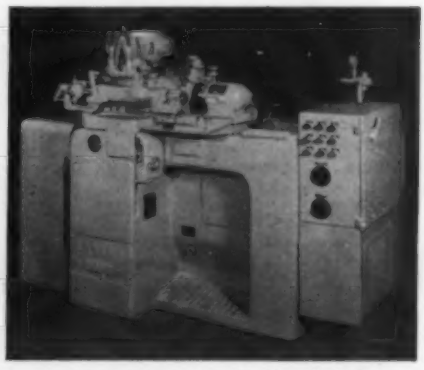

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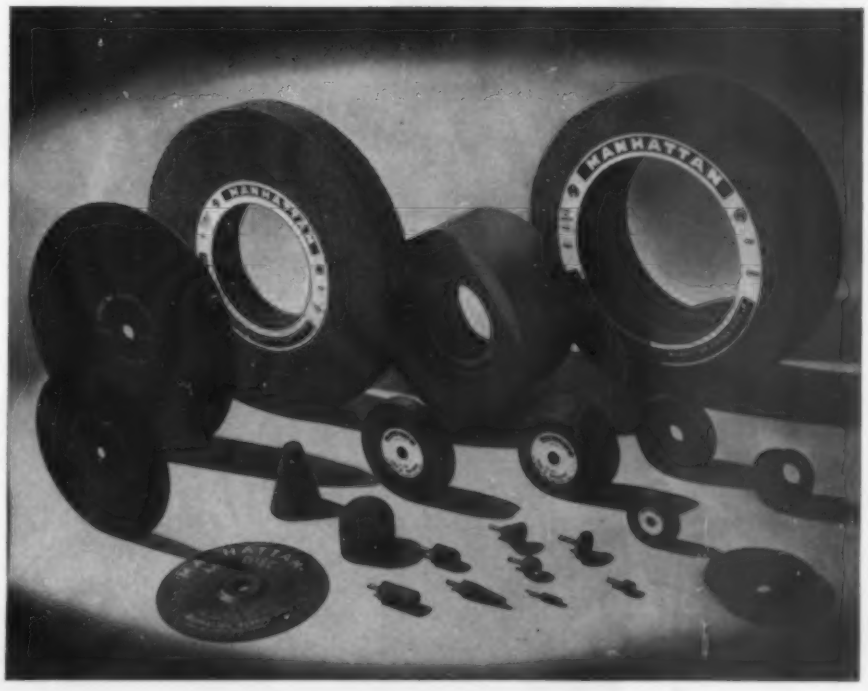

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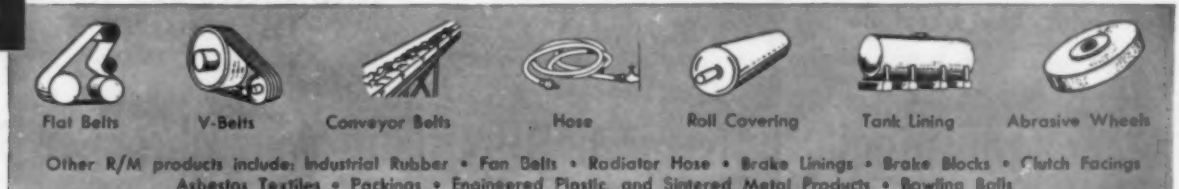

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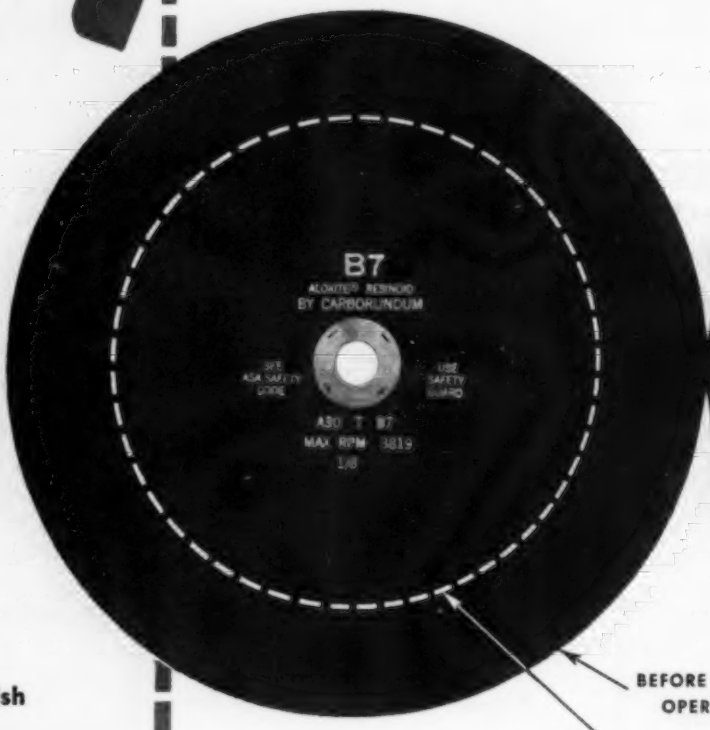

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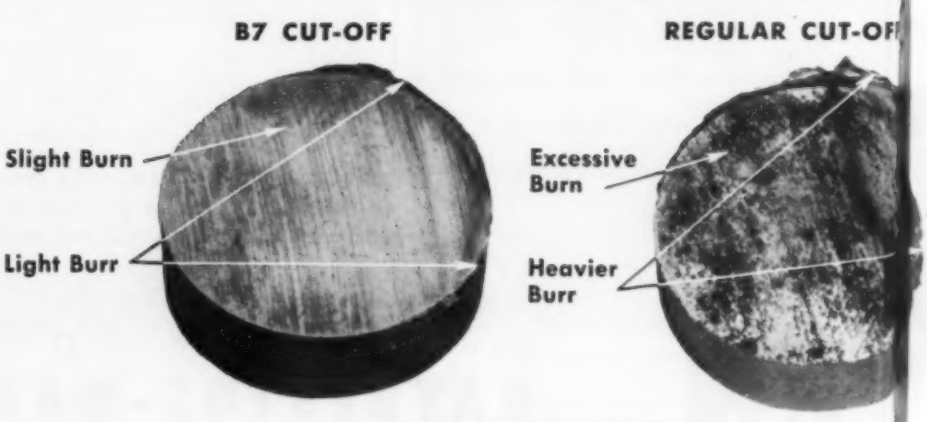

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The Editor's Page

On the Subject of Change and Abrasive Belts

ONE of the most difficult jobs man has had to face since the days of primates is the making of a change. Man is so constructed that the contemplation of a change from the accepted to the new loosens hundreds of centipedes which crawl up and down his spine, causing mighty shakings and quakings in the boots. Most people avoid this creepy-crawly, shaking-quaking feeling with grace and agility—they simply resist change.

We don't think members of the grinding fraternity are either more or less human than their brethren in the milling, shaping or turning fraternities. Resistance to change makes rutfellows of us all. The untried must be fought with lance and crossbow.

What brings all this to mind are two small bits of information—all editors tote these little pieces of facts about with them much like squirrels do their nuts, hoarding this against a cold winter's day—information on the use of abrasive belts.

It is estimated that only 5% of operations which could be performed cheaply and quickly by abrasive belt machining are being performed by belts today. Now this is a small percentage indeed. Especially in view of the advancements made in belt and belt grinding technology.

On the other hand listen to this: in 1946 it cost $15 per thousand feet to grind hot rolled pickled steel for automobile bumpers to a finish of 14 to 17 micro. Since 1946 a cost reduction of 66% has been gained through the use of better abrasive belts, achieving at the same time a micro finish of less than 10. Speed has increased from 23 fpm to 40 fpm.

Thus, some of the savings which can be realized through use of abrasive belts.

The machines which are available to perform belt grinding operations are splendid. They range from huge monsters using a belt yards wide to small precision machines employing a quarter-inch belt. They finish aluminum skins for aircraft, alloy steel rollers, welded tanks (inside and out), tubing, steel and aluminum castings, in fact, every type of material used in metalworking today for an endless variety of parts. They are a production or a maintenance tool for either large production runs or small clean-up operations. They are versatile, economical, fast. They should be investigated by cost-conscious executives.

They are not, however, the answer to all the ills of the world. We do not agree with over enthusiastic proponents of belt usage that ". . . . if you cannot lick the problem any other way, solve it with a belt." This is a bit of over-simplification with which sager heads of the industry are not in accord.

At any rate, if some have been resisting belts because of their inherent unwillingness to make a change for one reason or another, it would be best to poke the head above the crowd and have a look at the belt literature and see where a belt operation could fit into the shop. One could easily change from a rutfellow to a beltfellow.

William F. Schleicher

One of the final operations of a satin finishing sequence on stainless steel kitchen sinks, using a wicking wheel.

Satin Finishes: Important in Polishing and

● TWO FACTORS contribute to the usefulness of stainless steel in its various applications in dairy equipment, kitchen and cafeteria uses, soda fountains, hospital equipment, etc. One is its chemical property which makes it naturally resistant to tarnishing, corrosion, and discoloration. The other is its ability to take and hold a highly polished surface finish. It is in the latter property that the fabricator of stainless articles should be especially interested. His efforts should be directed at obtaining the finish specified for a particular application by using the best available techniques from a time-and-cost standpoint. In order to produce finishes that meet specifications, abrasives must be of the correct grit size and used in the correct sequence; wheels, discs, or drums must be the best type for the particular job at hand.

The discussion which follows is a summary of techniques and general principles followed in grinding, polishing, and producing satin finishes on stainless steel. Particularly noteworthy are the recent advances which have been made in satin finishing techniques.

Grinding Operations

Portable grinding and polishing equipment has proved to be most useful in stainless steel work. Flexible shaft machines, which have been in use for many years, are widely employed because of their ease of handling.

It is important that certain basic precautions be observed in grinding stainless steel. Since the material is easily contaminated, wheels should be kept free of foreign material. Wheels must not be used on other materials, especially iron, to avoid rust and discoloration. They should be frequently dressed. And cleanliness of all equipment is essential to avoid scratching the work. When solid wheels are used, they should be carefully trued to prevent hammering the work.

Solid wheels are used to begin sharp cutting action on the piece to be finished. It has been found that rubber or resinoid bonded wheels are more satisfactory than vitrified types for several reasons. The softer bonds run cooler and do not load as rapidly as vitrified wheels. In roughing operations higher surface speeds can be maintained than with vitrified types. (Vitrified wheels must be held to 4000-6000 surface feet per minute, while rubber or resinoid wheels can be run up to 9000 surface feet per minute, with correspondingly faster cutting action.)

Resinoid wheels are useful particularly where the required final finish is not too high. They are good

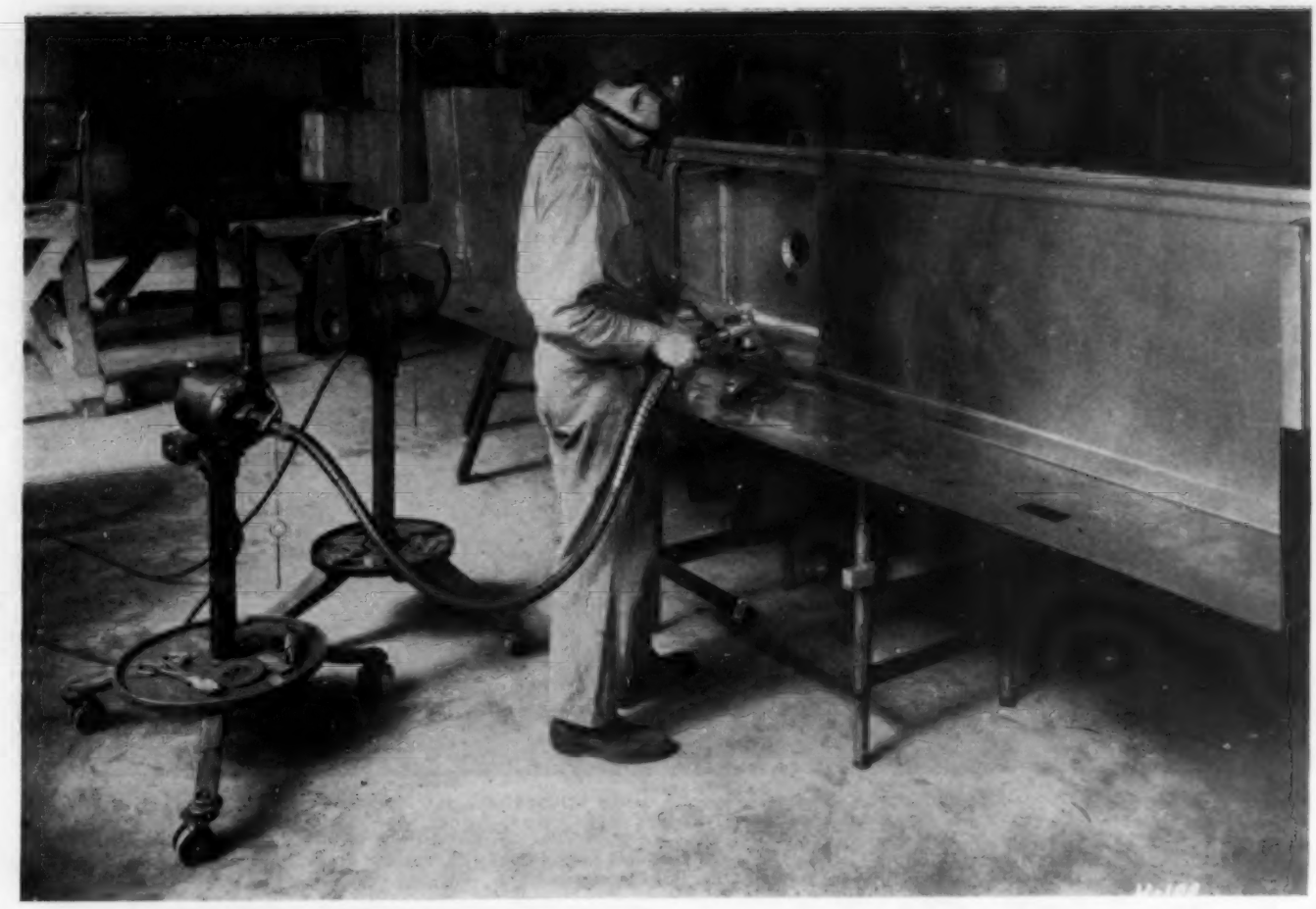
Using setup wheels to remove surface imperfections.

Grinding welds with rubber drum sander. Satin finishing in background.

Grinding Stainless

by **Walter A. Kerr**
R. G. Haskins Company
Chicago, Ill.

Satin Finishes can be produced at considerably less cost than brilliant mirror finishes. Savings can be made through the purchase of lower grade mill finishes as a starting point for finishing operations. In many cases a No. 2B finish can be brought up to a No. 4 finish with a wick wheel dressed with No. 80 grit silicon carbide compound.



Blending of welds using an abrasive disc.

for rough grinding of tough weld beads. Though the bond is semiresilient, the resin wheel leaves lines which require heavy polishing for fine finishes.

Rubber bonded wheels find universal application for all stainless steel welds because of their extreme resiliency. The work area can be blended with the surrounding surface to minimize subsequent polishing. And the rubber bonded wheel is necessary for final grinding before sanding and polishing are done. Chatter and gouging of the workpiece are eliminated. Rubber bonded wheels wear more rapidly than other types, but they cut faster because they constantly present fresh abrasive grit to the work surface. The increase in cost due to fast wear is more than offset by savings in labor costs resulting from rapid cutting.

As to the techniques of grinding, it will be necessary to point out general principles only, because each application requires a rather specialized approach. For example, the size of weld beads to be removed will vary from one job to the next, depending on the skill of the welder and the efficiency of his equipment. In any case, coarse abrasives are used at first, followed by successively finer grits.

It is first necessary to snag off most of the welding rod material. Straight or cup type vitrified or rubber-bonded wheel with aluminum oxide 16 to 36 grit or a sanding disc with a flexible backing pad are suitable for this operation.

Using this coarse grit the high spots along the weld bead are ground off, resulting in a bead height just slightly (about 1/16″) above the surrounding surface. Then, using a finer 60 to 80 grit, the weld is ground approximately flush with the surrounding area. It is important that grinding be done along the weld bead instead of across it, to avoid cutting into the adjoining metal surface. Motion of the wheel should be continuous, because localized heating may buckle the stainless or cause loss of corrosion resistance. The wheel should not be forced into the work, but should be allowed to ride on the surface so that the grit can cut naturally as a result of surface speed.

To remove scratches produced by wheel grinding, the rest of the weld is blended with surrounding metal using rubber sanding drums and abrasive discs, sleeves or belts. Some experimentation to find the proper grit size may be necessary, but in general an abrasive about 20 grit numbers finer than the last rubber wheel should be used. For example, if the final wheel operation was with a 60 grit rubber wheel, an 80 grit sleeve should be tried on the sanding drum. This is followed by progressively finer grit drums, depending on the final finish required. The original polishing lines of the metal sheet should be followed as closely as possible at this stage of the operation, so careful handling of the sander is important. The finest sanded finishes are obtained by using a lubricant. The lubricant recommended is a compound of

mutton tallow and stearic acid at least 50% saponified. Solid mineral lubricants tend to clog the abrasive and retard cutting, so they are not recommended.

Since most stainless steel fabricators use sheets finished to requirements at the mill, it is usually necessary only for them to blend the welded areas with the original sheet finish. A standard No. 4 finish can be obtained by using a lubricated 120 grit drum for the final sanding operation. For a No. 7 finish, successive lubricated sanding with Nos. 150, 180, and 220 are required, followed by 320 grit with heavy lubricant.

The operations which follow grinding depend entirely on the final finish selected for the fabricated stainless articles. A number of finishes are in common use, each of which has distinct advantages to the final user; we shall not attempt to point out these advantages, but merely to outline finishing procedures. The finishes available include satin finishes and more highly polished finishes.

Satin Finishing

Satin finishes for stainless steel have gained great popularity, and indications are that even further applications will be made, especially in the home appliance field. Satin finishes meet the requirements of most states for dairy and food processing applications. They can be produced at considerably less cost than brilliant mirror finishes, and savings can be made through the purchase of lower grade mill finishes as a starting point for finishing operations.

As an alternative to disc or drum sanding, sewed buffs are sometimes used. Because of their comparative softness, flexible sewed fabric buffs coated with glue-bonded grit are ideal for removing scratches and imperfections in areas to be satin finished. To prepare these buffs they are stacked on an arbor and dressed with the glue-bonded abrasive grit. They must be allowed to dry thoroughly before use. Less care in handling these buffs is required than when using a hard wheel or a rubber sanding drum since the sewed buffs do not cut as rapidly or deeply. They follow either flat or contoured surfaces equally well. Care should be used to set up the scratch lines in the work in the direction desired for the final satin finish which is to follow. The grit to be used will be determined by the amount of cut to be taken, and for most applications the last grit used at this stage is a No. 80.

Wicking Wheels Used for Final Satin Finish

To produce the final satin finish, wicking or string wheels dressed with glue bonded grit compounds are used. A few passes with a wicking wheel are usually all that is required—an operation that takes only a few minutes. With the variety of abrasives available today, a wicking wheel can produce a final finish that will satisfy any requirement from a coarse dull to a bright satin. Satin finishes have the advantage of blending with die marks and other imperfections.

A saving can be made on the purchase of lower grade mill finishes prior to wicking operations. In many instances, a No. 2B finish can be brought up to a No. 4 finish with a wick wheel dressed with No. 80 grit silicon carbide compound. Thus substantial savings can be realized, especially when using sheets up to 14 gauge.

The wicking wheel operates at the comparatively slow speed of 1000 to 1450 surface feet per minute. For example, a 6" wicking wheel would be operated at about 1000 rpm. Since their flexible, cushioned surfaces remain soft, they "hold" an abrasive better than other wheels. Because of this fact, it is possible to increase grit size sequence faster. And correct care of the wheel, including periodic removal of old ab-

STANDARD MILL FINISHES

Stainless steel producers supply sheets and strips in cold-rolled, pickled, and polished finishes which are standardized to a great extent. Choice of mill finish depends on the application. A description of some typical standard finish identifications follows:

No. 1—Hot-rolled, annealed, and pickled. Used principally in industrial applications, such as in chemical vessels. Rarely used where subsequent polishing is intended because of dull finish.

No. 2D—Dull cold rolled. Sheets are cold rolled before final annealing and pickling and have much better finish than No. 1 sheets. Usually specified for articles to be polished after severe forming. Ductile.

No. 2B—Bright cold rolled. Sheets have bright finish obtained by final light cold rolling. Slightly harder than No. 2D, and cannot be deeply drawn. Suitable for shallow pans, trays, small stampings.

No. 4—Standard polish on one or both sides. Supplied where "polished" stainless is specified; surface has been ground for uniform bright finish. Suitable for shallow drawing or forming.

No. 7—High lustre polish. Semi-mirror finish brighter than No. 4.

Nos. 4 and 7 can be used as received, where only fabrication is done.

rasive with the burr edge of a piece of scrap stainless steel, insures a soft polishing surface that lasts for years.

No appreciable pressure is required when using wicking wheels, as the cutting action depends on the abrasive and the speed of the wheel. The wheel should not be bent to any extent when in contact with the work. It is desirable that polishing equipment be designed or arranged so that the wheel can travel the full length of the work in one stroke. If it is not practical to use a suspended machine to accomplish this, greater care must be used in blending successive areas of the work to keep the finish pattern uniform and continuous.

The wick and string wheels should be dressed or "set up" with glue bonded grit compounds. The best known are Butler, Reliance, and Lea. These compounds come in stick form, usually in airtight lead foil wrapping to prevent the glue bond from drying and hardening. These tubes of compound should be kept with the exposed end immersed in water after the tube has been opened.

Both of these compounds come in aluminum oxide grit and silicon carbide as well as several natural and combination grits. Most frequently used are the Lea No. 1-K7 silicon carbide 80 grit, No. E-3 silicon carbide 120 grit and the Butler 180 and 120 aluminum oxide grits.

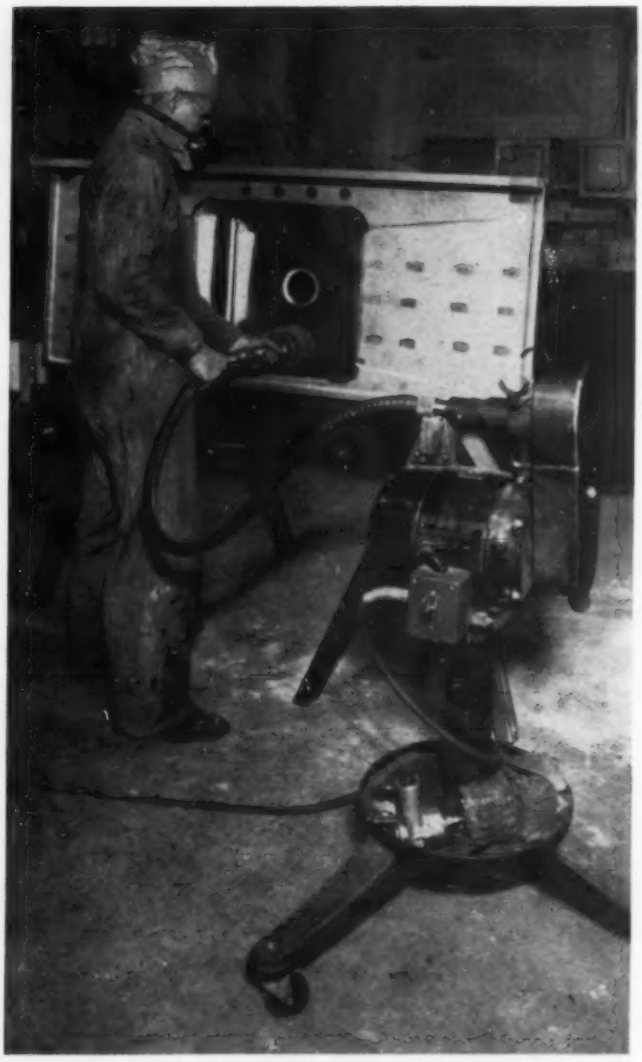
The compound must be allowed to dry completely after the first application to wick and string wheels or sewed flexible buffs. The result is in effect a "set up" wheel. The first application should be generous, working the compound into the wheel by hand before the wheel is put on the machine. After the first application, the wheel can be allowed to stand overnight in a heated area to dry, but the second and successive applications can be made while the wheel is rotating on the spindle, and if allowed to spin for a couple of minutes will be dry enough to use on the stainless steel surface.

Polishing

In securing very highly polished surfaces on stain less steel, the use of fabric wheels with self-lubricating abrasive compounds in stick form is very popular. Their use generally follows sanding operations with Nos. 180 to 220 grit drums. Good practice indicates the advisability of polishing with an interval of 20 to 40 grit numbers between successive operations. As in the case of drum sanding, a No. 120 grit will produce a No. 4 finish, while No. 320 grit compound will give a No. 7 finish.

Fabric wheels used in polishing should be soft and well ventilated. They are made up of sewed sections of unbleached muslin with cardboard spacers. Compound should be evenly distributed over the polishing face of the wheel, and wheel pressures should be kept very light. Wheel speeds to give 7000 to 10,000 surface feet per minute are recommended.

● ●

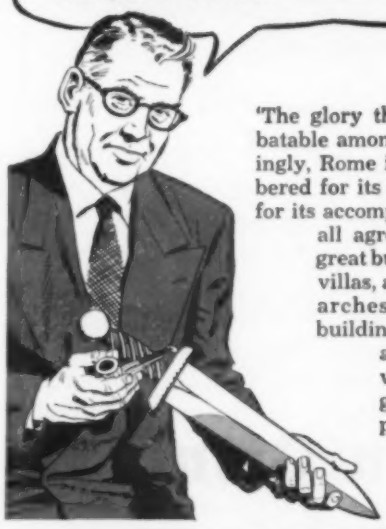


Satin finish operation using flexible shaft machine and wick wheel.

Final satin finishing with string wheel. Note the protective strip laid on the sink's horizontal surface to avoid swirl pattern from end of wheel.

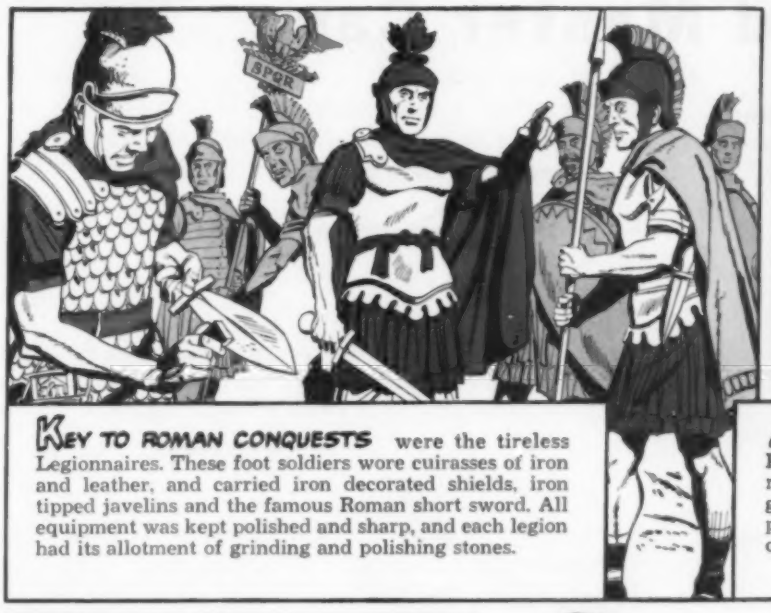
ABRASIVES WERE AN AID TO ROMAN construction and conquest.

NO. 5 OF A SERIES
ON THE HISTORY OF ABRASIVES
BY CHICAGO WHEEL & MFG. CO.



'The glory that was Rome' is debatable among historians. Surprisingly, Rome is more often remembered for its decline and fall than for its accomplishments. However, all agree the Romans were great builders. Their temples, villas, arenas, and triumphal arches testify to this. In building construction as well as in the weapons of war, abrasives and grinding played a part.

IN THE DAYS of the Empire, the principal building materials were stone, brick and cement. For the more important buildings slabs of marble were laid over the rough structure. The removing of burrs on stone, the smoothing of mortar and the grinding and polishing of marble was done with abrasive rock, sandstone and pumice.



KEY TO ROMAN CONQUESTS were the tireless Legionnaires. These foot soldiers wore cuirasses of iron and leather, and carried iron decorated shields, iron tipped javelins and the famous Roman short sword. All equipment was kept polished and sharp, and each legion had its allotment of grinding and polishing stones.

ABRASIVES were common to the Roman home. Pliny and Lucian wrote of metal mirrors, made of a mixture of copper and tin, which required frequent grinding to enhance their reflective quality. For this purpose a sponge full of powdered pumice-stone was often kept hanging near the mirror.

THROUGHOUT ancient history man depended on muscle power to grind, smooth and polish. Abrasion was a tough, time consuming occupation. The scientific approach to making abrasive wheels today, plus the high speed tools that operate them, have taken the time and labor out of grinding.

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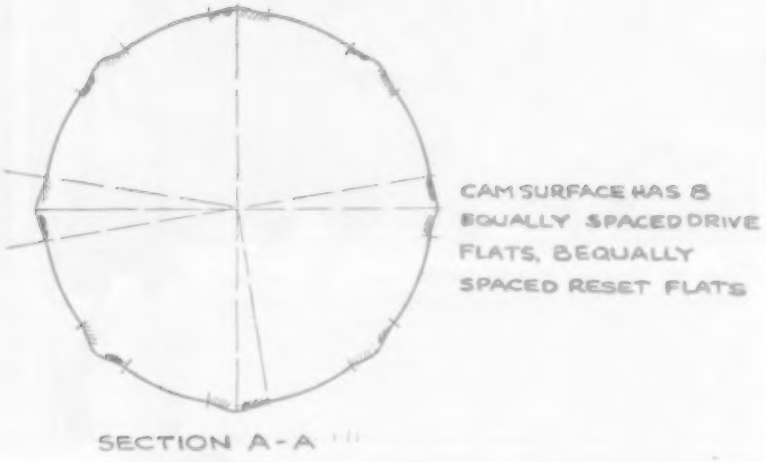
Their Problem:

Grind tapered cams to plus .0002-in. and minus .0000-in., holding 2 to 4 microinch finish.

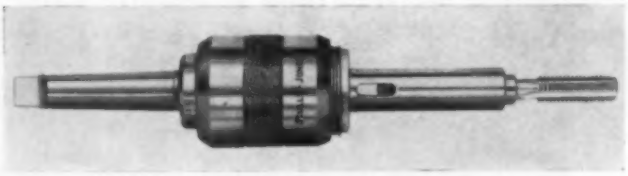
They Solved it by . . .

Making a Special Cam Grinding Fixture and Master Cam

By **Jack Kenyon,** Associate Editor



1. Cam drive. Grinding operation on its cam surface is the subject of this article.



The Scully Jones Safe Torque Tap Driver is a torque limiting tap holder which is designed to reduce tap breakage. Its over-running roller drive releases when torque reaches a dangerous level as adverse machining conditions are encountered.

● IMPORTANT to the operation of the Safe Torque Tap Driver is a part known as the cam drive. The precision grinding of its tapered 8-lobe cam surface is a very interesting operation. See figure 1. Since it determines the accuracy with which the torque-limiting device functions, this operation has been given considerable attention.

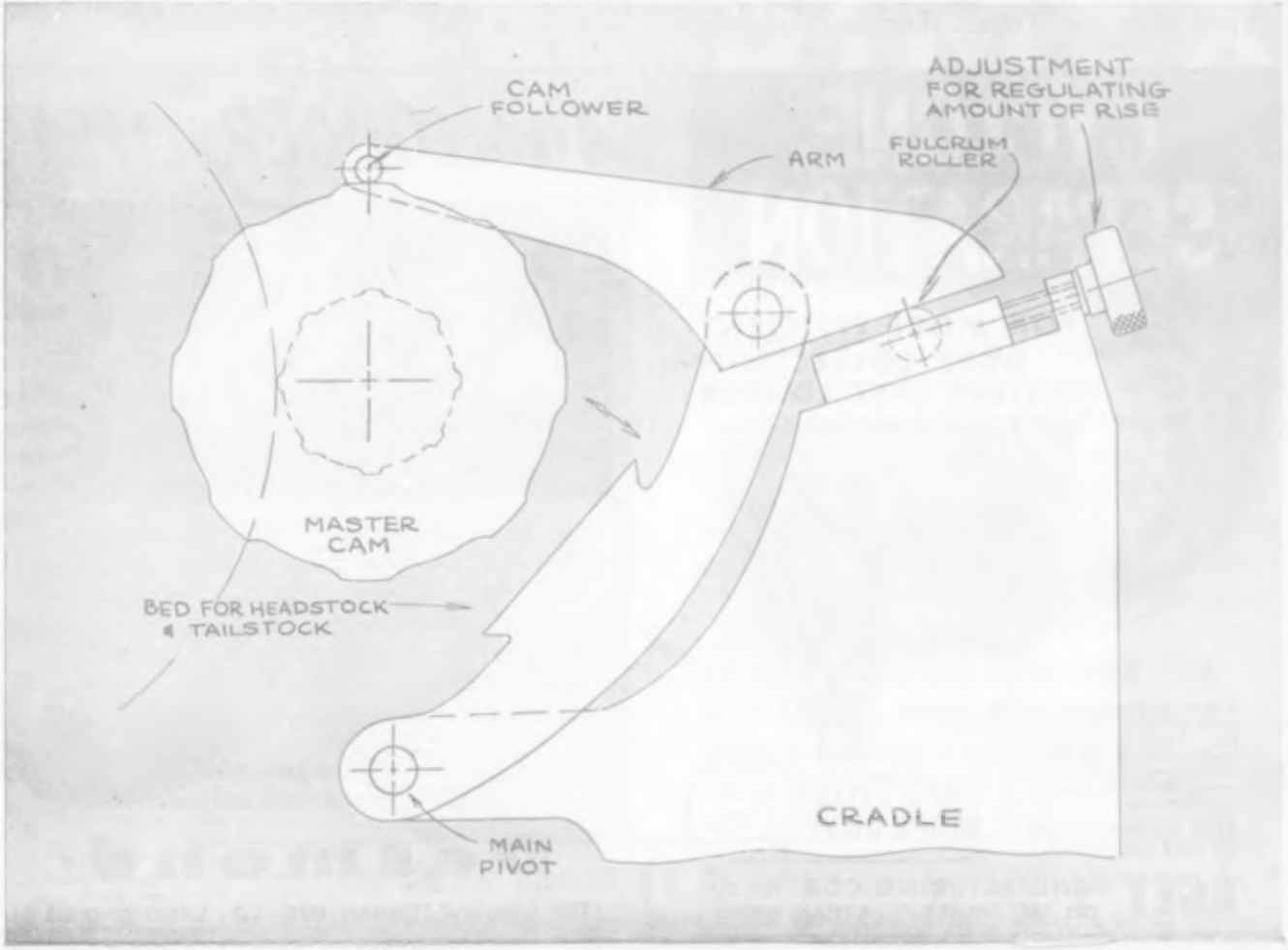
Unusual problems were encountered in the design and production of the cam drive. The high compressive stresses (about 500,000 psi) developed in the part ruled out the use of ordinary lubricants. The material chosen for the part was Timken Graph-Mo, a self-lubricating graphitic tool steel which has been found to reduce galling tendencies considerably. In this application its hardness must be 58 to 60 Rockwell C because of thin (3/32-in.) cross sections of the part. This hardness is obtained by cycle heat treatment in a salt bath—ordinary heat treating would produce part distortion. Both the hardening process and the choice of material were critical because of the high torsional and compressive stresses to which the part is subjected in use.

Grinding of the tapered cam surface, the last operation performed on the part, involves several important requirements.

Taper of this section is .2408-in. per foot, with a taper tolerance of $\frac{+.00005\text{-in.}}{-.00000}$; size tolerance is $\frac{+.0002\text{-in.}}{-.0000}$. A 2 to 4 microinch rms finish is specified.

As to the cam itself, it was necessary to hold the rise angle constant within 0°-20′ to maintain desired uniformity of the parts. The tolerance of the

2. Master cam linkage which produces motion of machine bed.

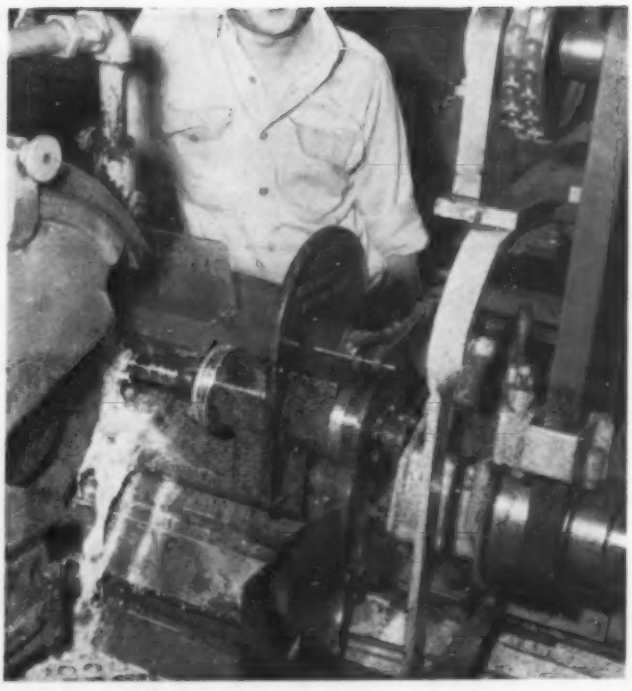


cam's curvature radii is $\frac{+.0001\text{-in.}}{-.0000}$ to insure a constant drop of the cam.

Rough cylindrical grinding of the taper is done first, then grinding of the cam contour in three steps. The attachment for cam grinding is of the cradle type, in which the pivoted bed moves in and out relative to the grinding wheel as the workpiece rotates. See figures 2 and 3. The live center in the headstock drives the work and is in turn driven through flexible coupling, allowing free pivoting between the master cam and the bed.

The operation is as follows: A master cam with eight lobes is used to control in-and-out motion of the workpiece. The master cam is connected to the spindle of the live center. A cam follower which rides over the master cam is attached to an arm. The arm rolls on an adjustable fulcrum roller and transmits the movement to pivot thereby creating movement of the bed about the main pivot. The amount of rise of the lobe on the workpiece is varied from zero to ten-thousandths by means of the fulcrum roller.

The rise and fall of the lobes on the workpiece do not correspond directly with the rise and fall of the lobes of the master cam, as can be seen from figure 2. The master cam does create the form and determines the number of lobes. For the rough grinding pass on the cam, a mixed aluminum oxide 60-L7



3. Cam grinding setup in operation.

wheel is specified; for finishing an 80-o7 is used. An ultra-fine finishing wheel AHFNBY is used for polishing. The wheels are 18-in. diameter.

Grinding cycle for the cam surface is about 20 minutes. The workpiece rotation speed is from 8 to 10 rpm for roughing and from 2 to 4 rpm for finishing.● ●

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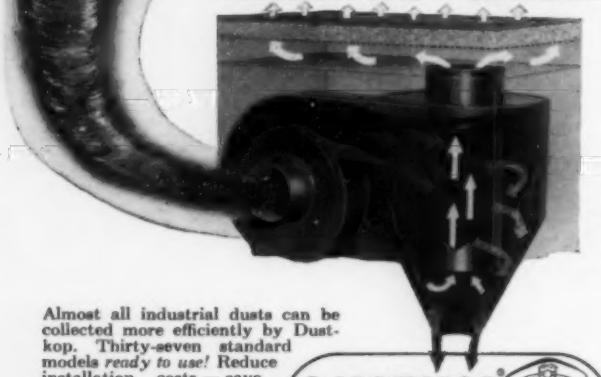

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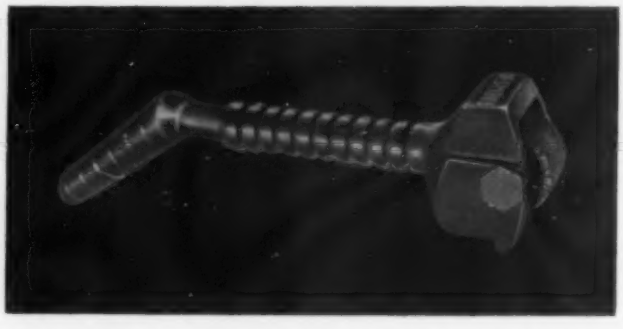

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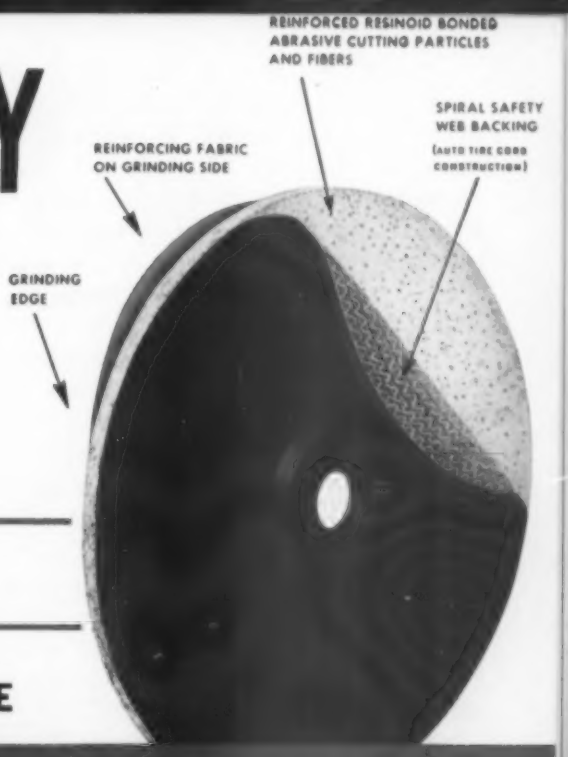
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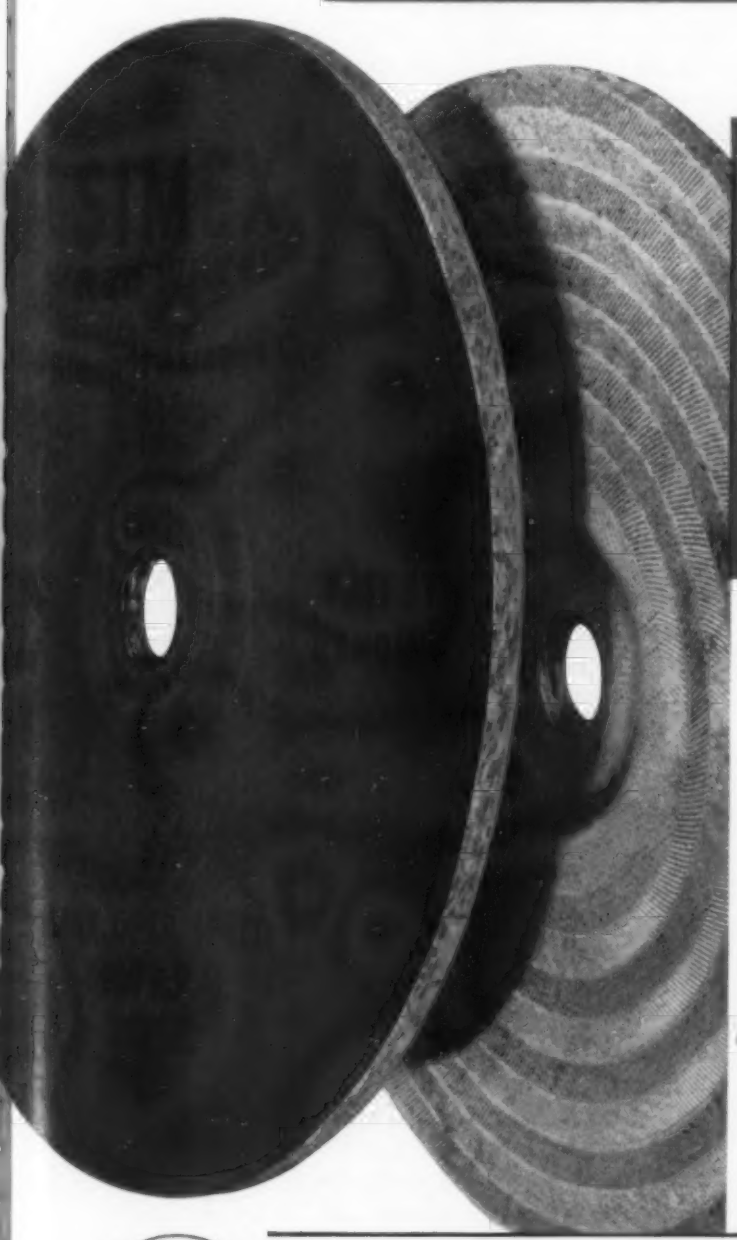

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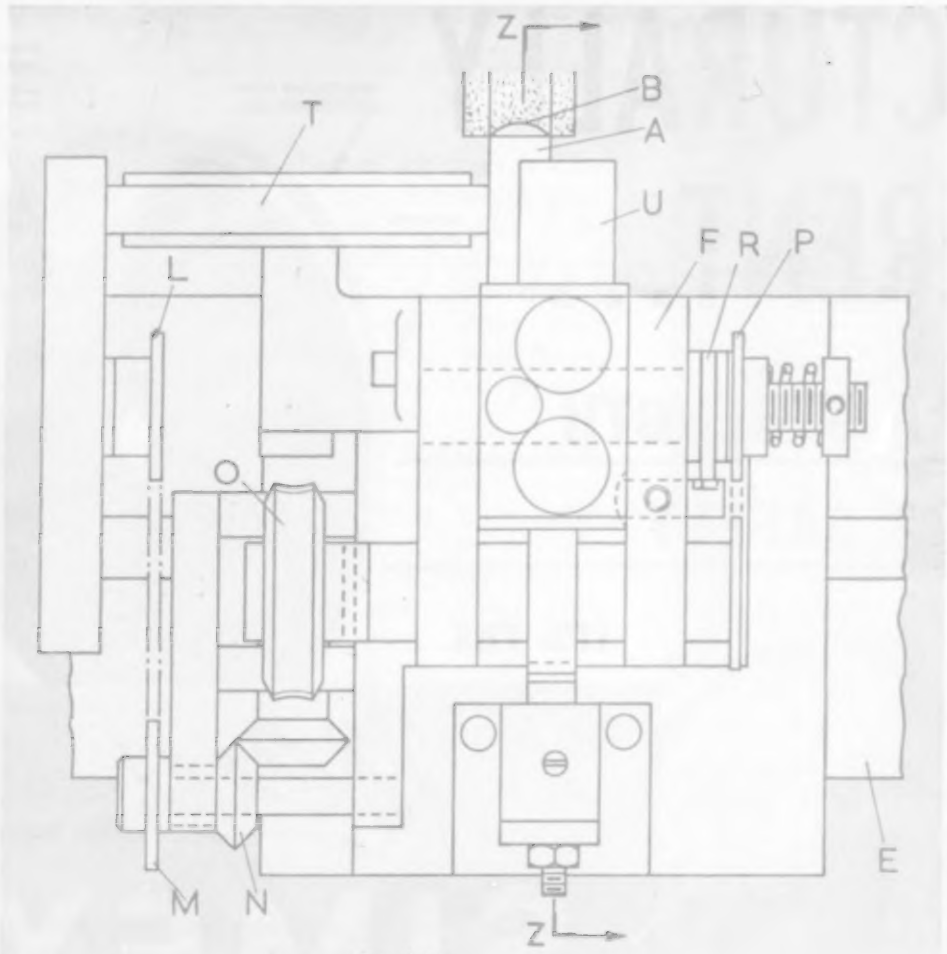
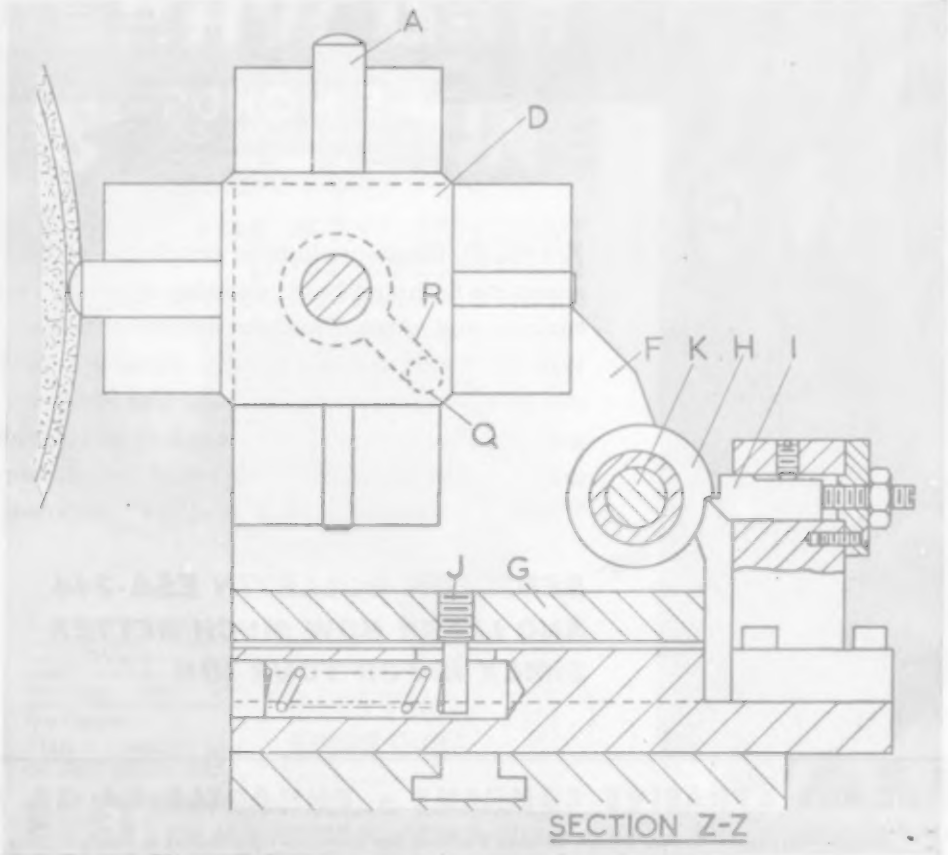


PLAN



SECTION Z-Z

Automatic

By **Clifford T. Bower**
Consulting Tool Engineer

- Problem was to grind the domed end of a hollow tappet. Dome must be concentric with the outside diameter of the cylindrical part of the tappet.
- Solution consisted of a special fixture providing an estimated production of 100 pieces per hour.

Tappet Grinding Fixture

● THIS fixture was designed for automatically grinding the domed end of the hollow tappet which is shown in section at **A** in **View X.** Requirements of the job were that the domed end be concentric with the outside diameter of the cylindrical part of the tappet which had been centerless ground in a previous operation. The estimated output required from the set-up when working at 100% efficiency was 100 pieces per hour. As the design of the tappet had been fixed and the future output was estimated to be absorbed over a period of years, it was decided that something fairly elaborate in the way of a fixture was warranted.

The technique adopted for grinding the rounded ends was to dress a part-circular groove in the periphery of the grinding wheel, as at **B,** and to rotate the tappet while its end was in contact with the grinding wheel. Since the tappet core was only rough-bored, some suitable means had to be provided for supporting the tappet on its exterior. A further requirement was that the work should be done on an ordinary cylindrical grinding machine which was allocated for the work. The actual fixture which was finally designed enabled the work to be done on any cylindrical grinding machine carrying a wheel of about 1¼ in. width.

With the automatic fixture illustrated, the operational procedure comprises loading a component on to the top pin **C** of the four-side work holder **D;** at an appropriate period in the automatic cycle, the work holder indexes through 90 degrees so that the tappet is pointing at the groove in the grinding wheel and is revolving on its theoretical axis. The tappet end is then fed automatically forward to the grinding wheel which finish grinds the domed head and brings the overall length to final size. The final operation in the cycle consists of retraction of the work from the wheel and indexing of the turret through another quarter-turn. During the indexing cycle the finished tappet slips off the pin on the turret and slides into a chute attached to the machine table **E,** but which is not shown.

It will be seen from the foregoing that the operator merely has to load tappets on to the top pin when it comes into position, gauge components occasionally for correct length and to dress the wheel periodically. The dresser is a simple tool, not illustrated, but is attached to the heavy cast-iron wheel guard on the machine. The radius struck by the point of the dressing diamond is constant but adjustment is provided for wheel wear compensation.

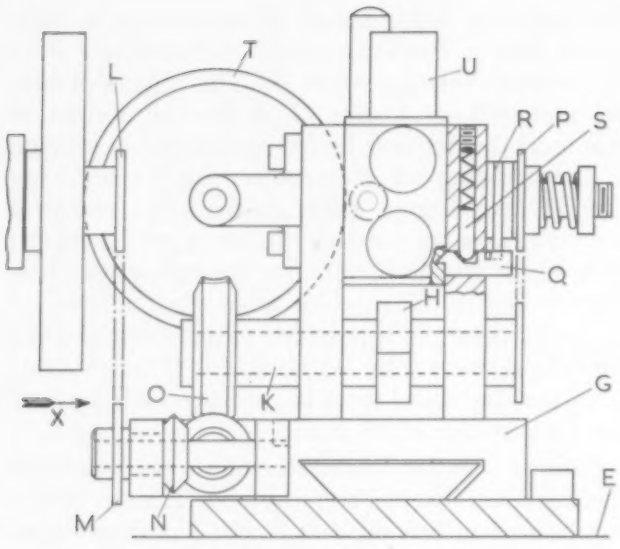
The way in which the fixture works is as follows: The indexing work holder **D** revolves on a horizontal axis in bearings which are bored for it in the vertical side members **F.** The side members are mounted on a slide **G** of dovetail section so that work holder may be fed in and out in relation to the grinding wheel periphery by the revolving cam **H** (See Section **Z-Z**). As the cam revolves it pushes against the stationary follower pin **I** mounted in a block which is, in turn, secured to the base plate bolted to the machine table. Fine adjustment of the follower pin is provided so that compensation for wheel wear can be obtained. Further compensation for wheel wear is also obtainable by feeding forward the wheel head.

Slide **G** is spring-loaded to retain contact between the cam and its pin and the arrangement of this can be seen in Section **Z-Z.** A pin **J** projects downward through a gap in the base and makes contact with the horizontal compression spring housed in a hole drilled in the base; the end of the hole is closed by a screwed plug.

Control of the automatic indexing and the reciprocating motion of the work holder is derived from the cam shaft **K** which is driven from the grinding machine work spindle. A small toothed sprocket **L** is mounted in the spindle mouth on a Morse tapered shank. It is connected by a sprocket chain to the second sprocket **M** mounted on a spindle. Some speed reduction of the cam shaft proved necessary to obtain 100 revolutions per hour, also a change in drive direction was necessary. The change in drive direction is obtained by the pair of bevel pinions **N,** the driven member of which is mounted on the end of the worm shaft of the worm reduction unit **O.** The worm wheel is mounted on the end of the cam shaft and drives it at the requisite speed.

It will be appreciated that the rotation of the work holder **D** is intermittent. The revolving cam feeds the work slide to the grinding wheel at a slow rate until all the metal has been ground off the rounded end of the component. The slide then retracts under the action of its spring when the cam has reached the position shown in Section **Z-Z.** At this point, indexing of the work holder through one-quarter turn takes place.

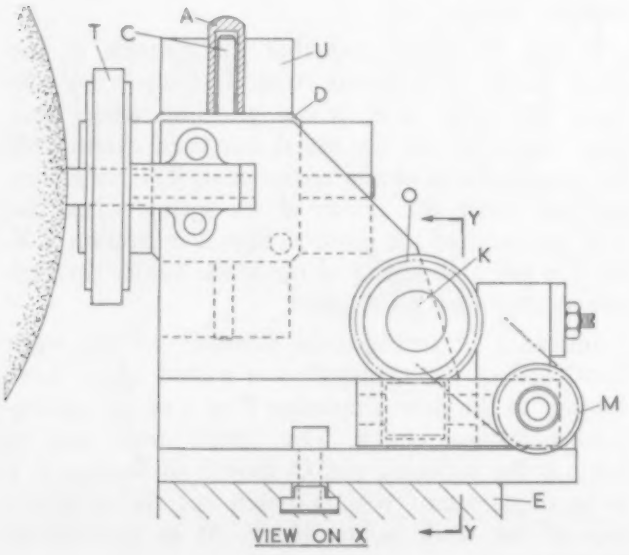
Indexing is arranged as follows: At the right hand end of the camshaft is a second chain drive leading to the driven member **P** of a simple spring-loaded friction clutch. The clutch drive slips as long as the indexing pin **Q** shown on Section **Y-Y** is in engagement with a notch cut for it in the side of the work holder block. At an appropriate



SECTION Y-Y

moment in the work cycle, the revolving arm **R** engages with a tangential slot in the indexing pin and pulls it backward and clear of the work holder block, thus allowing the clutch to cease slipping and to drive the work holder through 90 degrees of rotation. The arm **R** is of narrow section and is clear of the indexing pin at the completion of the indexing movement; the pin is spring-urged into contact with the side of the work holder block and jumps forward into the next notch when this comes into position. Spring loading of the indexing pin is obtained from a vertically disposed plunger **S** the end of which bears on a sloping face on the indexing pin.

During grinding, the tappet is rotated on its axis, and the method of obtaining the drive for this can be seen from the plan view. To the spindle nose of the grinder work head is attached a plain face-plate which revolves with it, and in contact with the face of the plate is the friction disc **T** made from a resilient material of bonded rubber and fabric. The disc revolves under the action of the face plate and at its right hand side is in contact with the exterior of the tappet which is rotated thereby during its in-feed to the grinding wheel.



While rotating the tappet is supported on its exterior ground diameter by a pair of freely revolving rollers **U.** The rollers form a V-block support into which the tappet is forced by the friction disc; there are a pair of them for each of the four work stations on the work holder block. The friction disc for rotating the tappets can be adjusted for position so that its axis of rotation is tilted. This tilting arrangement has been provided to ensure that the disc tends to pull the component back into contact with the surface of the work holder block to ensure accurate length control.

In use, a tappet is dropped on to the top pin **C;** the cam rotates until the slide is pulled back from the grinding wheel by the spring provided, then the arm **R** sweeps around and pulls back the indexing pin. Freed from restraint, the friction clutch rotates the work holder which is stopped by the indexing pin jumping into the next notch. During indexing, the cam has been feeding forward the slide once more and the tappet end is in close proximity to the grinding wheel. As the work holder indexes into position, the new component is pressed snugly into contact with the supporting rollers by the friction disc which then revolves it. When the cam has completed its revolution, the indexing cycle occurs again, together with the retraction of the work holder and the component, now ground, slips off the pin and into the chute.

In the actual grinding fixture, the worm wheel, chain drives and bevel gears were covered to protect them against dirt and to protect the operator against injury. ● ●

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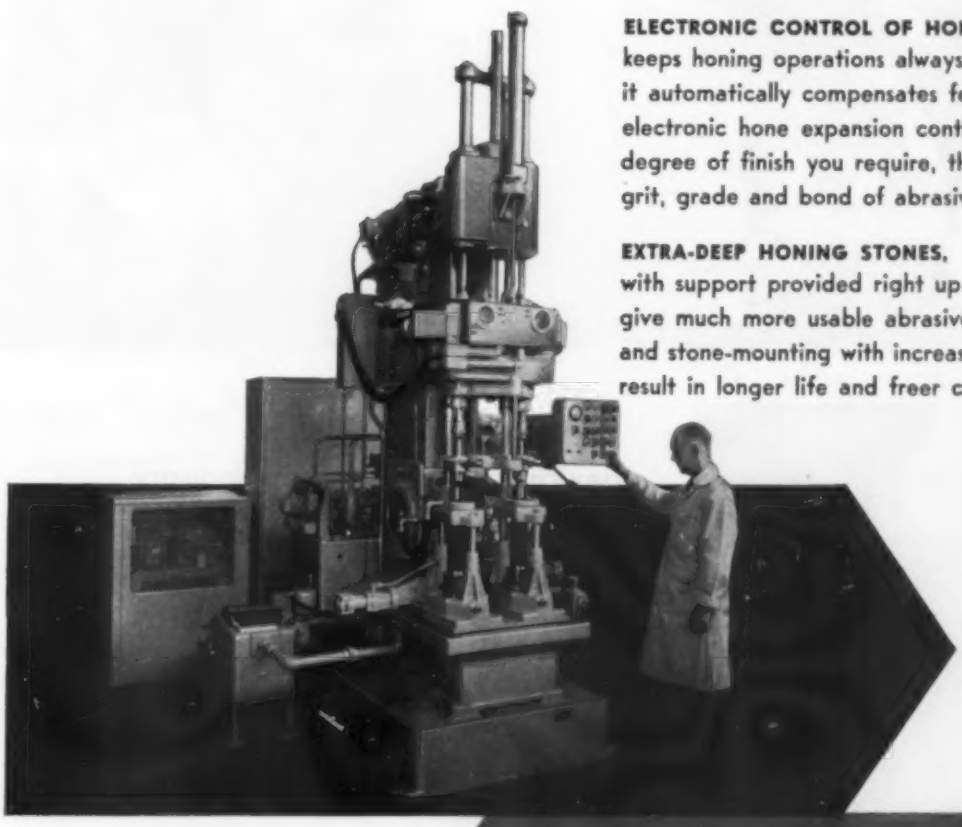

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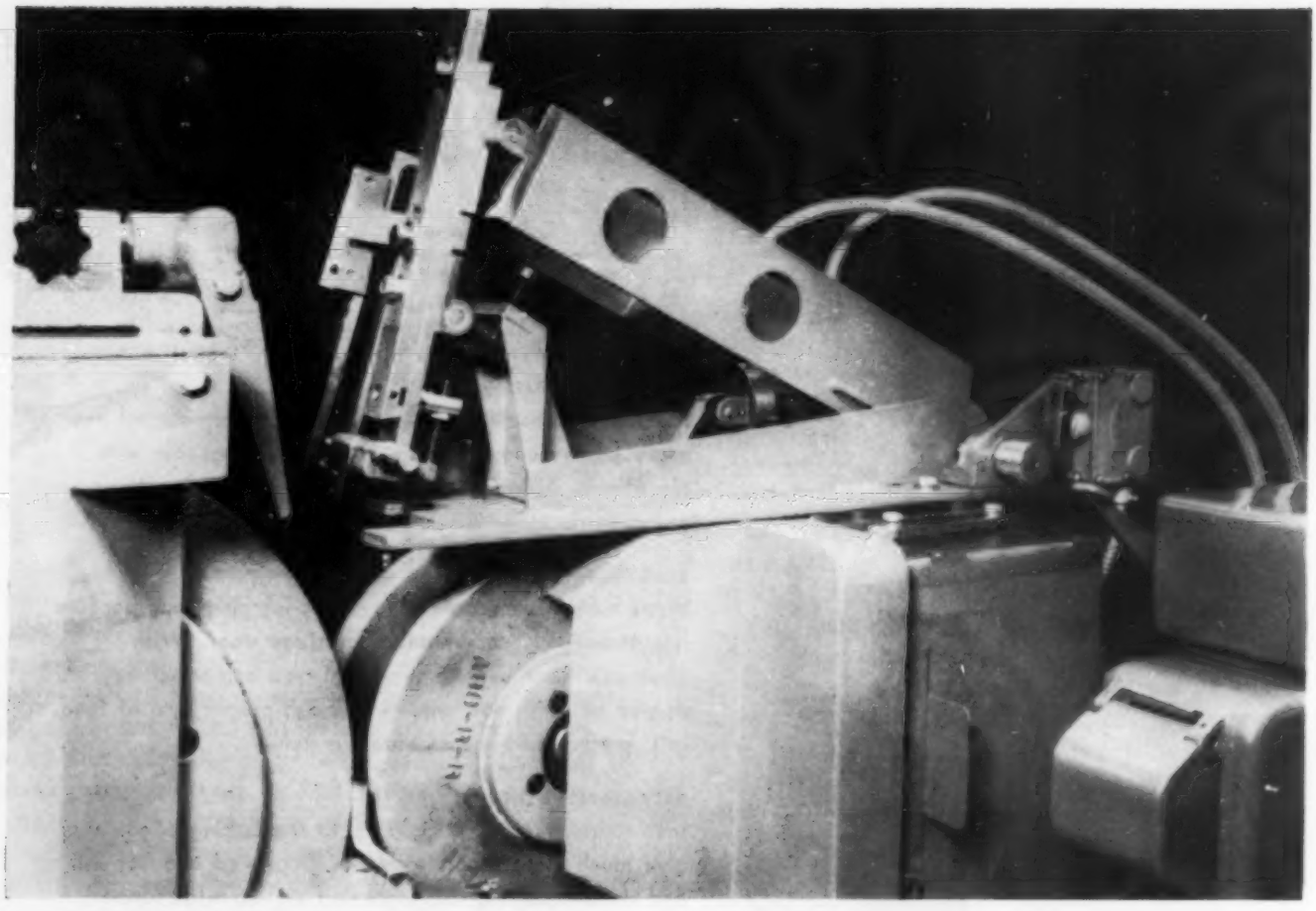
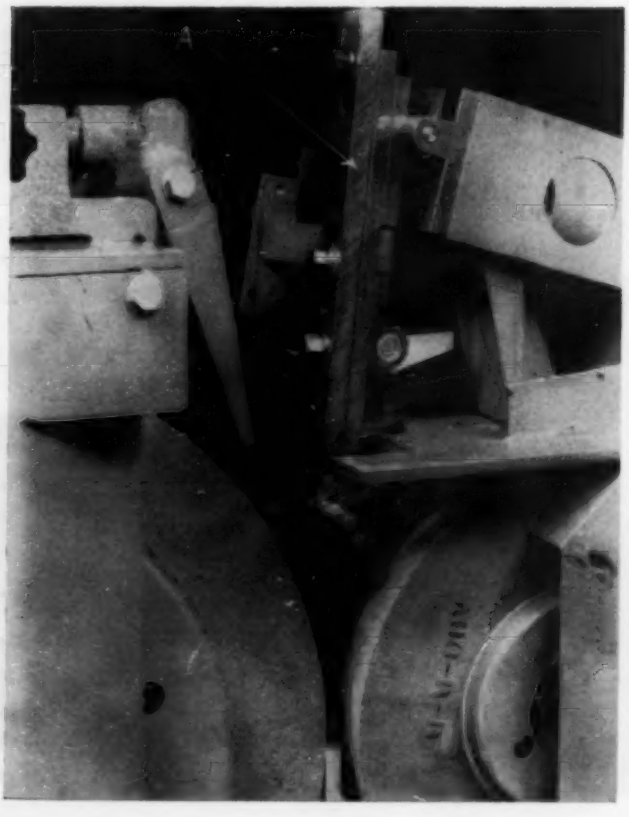




2 (Top). Method of loading on a Scrivener Controlled-Cycle centerless grinder.

3 (Bottom). Showing piece clamped for safety during its descent to workplate.

Two grinding wheels and special loading device help British cycle industry

Meet Competition

London: Special to **Grinding and Finishing**

● DURING 1954, the British bicycle industry produced 3.2 million machines, of which 2 million (62%) were exported, the main reason for the strong competitive position of the industry in world markets being the very extensive retooling which has taken place since the war. Particular interest attaches to some of the machine tools which are responsible both for the very close limits of accuracy and the low cost of British machines and components.

A High Production Machine

One of the most important components which might almost be termed the key piece of a cycle is the bottom bracket axle, figure 1, which has to be ground on four diameters and two radii for the ball bearings. The method which has been evolved by the firm of Arthur Scrivener, Ltd., Birmingham,

That the bicycle industry of Great Britain is efficient is proved by the fact that constant demands for tariff protection are made by every country which has a bicycle industry. In the United States, with a production of 2 million machines annually, both an increase in import duties and the imposition of an import quota have been demanded to check the import of 500,000 machines.

Discussed in this Article:

- ✓ grinding four diameters and two radii in one operation
- ✓ two wheels and two regulating wheels used
- ✓ production is 450 an hour
- ✓ special loading device used
- ✓ interesting hopper feeding device and locating method
- ✓ piece is as long as it is wide

With Ingenious Tooling

Great Britain is for all the diameters and radii to be ground in one single operation on a special centerless grinding machine, removing .005 in stock to limits of plus-minus .00015 in. for size and within .0002 in. for roundness at the rate of 450 per hour.

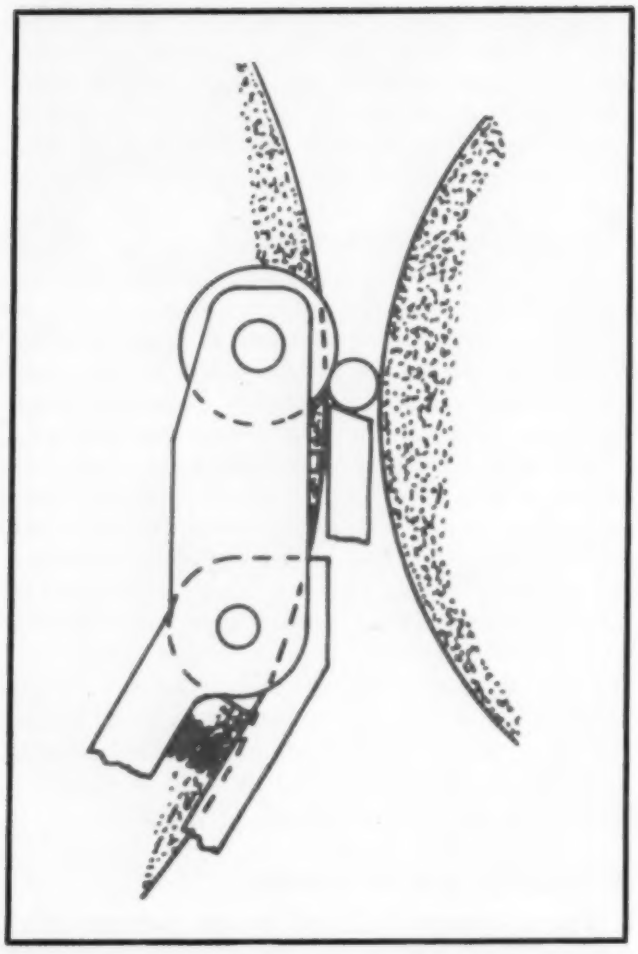
Special Loading Device, Two Wheels

The latest method involves the employment of a Scrivener controlled-cycle centerless grinder equipped with a pair of grinding wheels, a corresponding pair of control wheels, and a special loading device for placing the component on the workplate between the wheels. The operation can be followed on reference to the photographs and diagram. In figure 2, the workpiece has been placed upon a cradle which is attached to the hinged arm located above the control wheel and when the controlled cycle of the machine has been set in motion by the depression of a small finger lever, the cradle descends laying the piece on the workplate. To ensure stability during the loading, the piece is gripped during its descent by the clamping member, A figure 3, which is raised as soon as the piece is safely on the workplate, allowing it to rotate freely. From this point, the cycle of the machine continues automatically. The control wheels advance placing the workpiece in contact with the grinding wheels, but immediately before this contact is made the center portion of the piece is engaged by a pressure roller located between the grinding wheels, figure 4, which is designed to afford greater frictional contact between workpiece and control wheels. The piece is then ground on the four diameters and two radii, the wheels and the pressure roller open again automatically to release the piece, the cradle returns to its raised position carrying the finish-ground piece with it ready for unloading and the insertion of a fresh piece.

A Difficulty and Its Solution

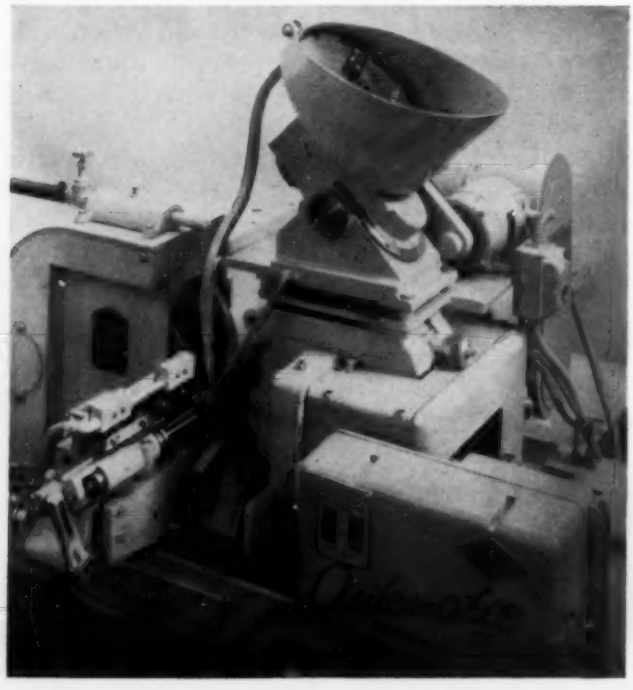
The advantage conferred by the pressure roller previously referred to will be more readily appreciated if it is borne in mind that the stock removal on this particular component is invariably not uniform, an excess of metal being usually left on each radius as a consequence of wear on the form turning tools during the preceding operation. When such a condition obtains, and it is desired to centerless grind the piece, the excess metal on the radii is likely to cause the piece to spin wildly on making contact with the grinding wheel instead of the speed of rotation being accurately governed by the control wheel as it should be in a centerless grinding operation. The pressure roller device shown in figure 4 effectively overcomes this tendency to spin.

1. A typical bottom bracket axle which is automatically ground on four diameters and 2 radii to limits of plus-minus .00015" for size at the rate of 450 hourly.



4. Pressure roller increases frictional contact between workpiece and control wheels.

5. Photograph of Scrivener No. 2 centerless machine with automatic push-feed mechanism and selector hopper.



Interesting Solution of the Hopper Selection Problem

The centerless grinding operation for the grinding of cones, figure 5, presents three specially interesting features: The location of the piece during the actual grinding operation, the loading, and the automatic hopper selection. A typical bicycle cone is shown at the bottom of figure 7, and this is automatically plunge-ground on the diameter and ball track on a No. 2 Scrivener controlled-cycle centerless machine, the piece when placed on the workplate being automatically advanced by the control wheel up against the opposing grinding wheel, and withdrawn on completion of the grinding operation when the wheels again open.

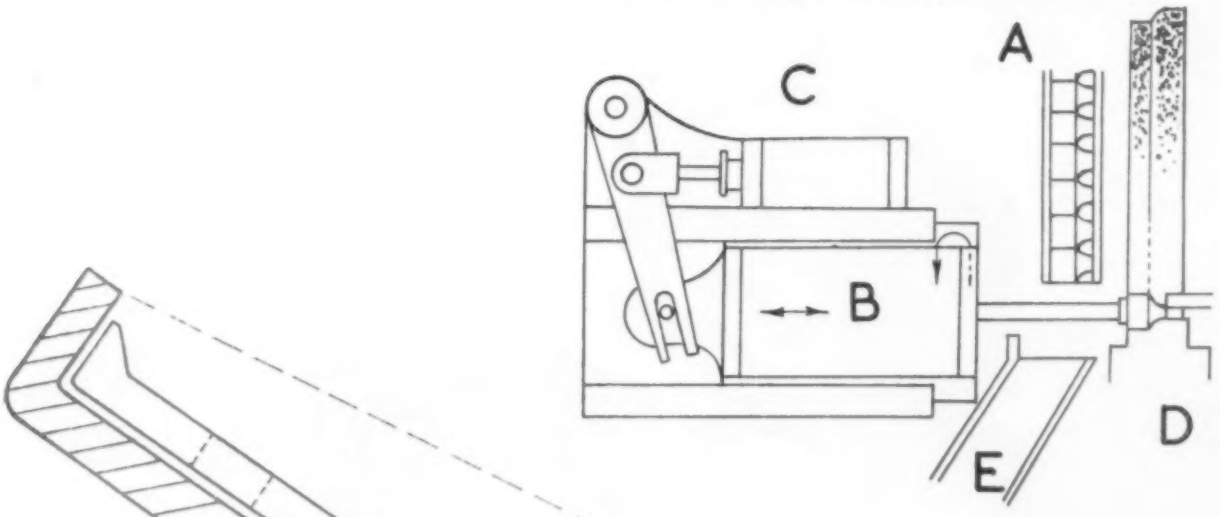
Loading and Location Present Difficulties

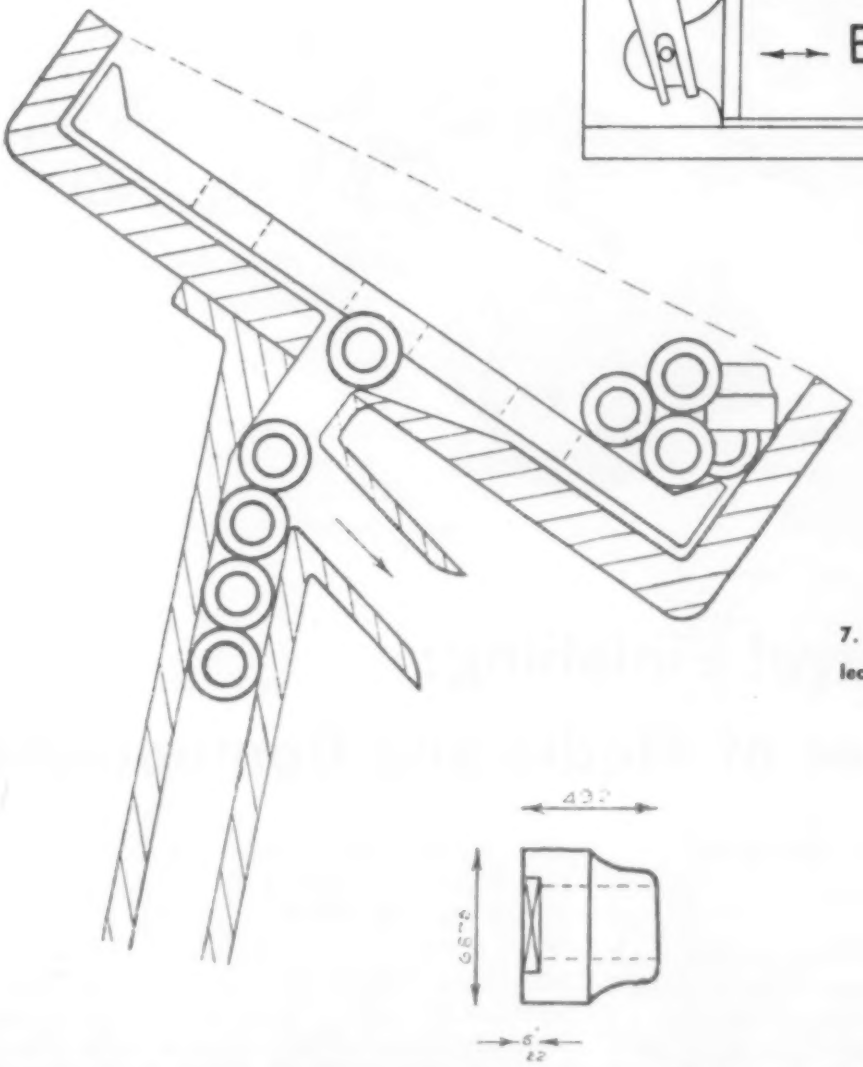
Loading and location of this piece presents certain difficulties both on account of its small size and its shape, the shape being such that if any attempt were made to deal with this on a normal centerless machine with hand loading there would be difficulty in maintaining the piece in position on the workplate for grinding owing to the tendency of the wheels as they come together on the plunge stroke to squeeze the workpiece forward off the workplate. In the machines to which reference is now being made, a special push-feed mechanism is employed operating upon the principle shown by the diagram, figure 6, where **A** is the loading chute, **B** a rotary locating workholder, **C** hydraulic cylinder, **D** formed workplate, and **E** the discharge chute. Operation of this push-feed mechanism is linked up with and synchronized with the controlled-cycle of the centerless grinder, so that at the commencement of each grinding cycle just before the wheels begin to close, the hydraulic cylinder **C** actuates the locating workholder **B** which advances, picks up the piece presented by the chute, and advances it on to the formed workplate **D.** The wheels then close in, and upon completion of the grinding operation the workholder **B** is again withdrawn, the finish-ground piece being knocked off during this withdrawal, and dropped down the discharge chute. It should be emphasized that the rotary workholder **B** is in no way a grinding mandrel, as it merely acts as a push rod, the shoulder serving to maintain the piece in the correct position during grinding, and to counteract the tendency of the closing wheels to force the piece forward again.

Feeding of the Piece

The feeding of this piece to the push-feed mechanism by means of an automatic hopper presents the difficulty which is so familiar to designers, namely that of selecting and handling a "square" piece, that is to say, a piece whose diameter is approximately equal to its length. Usually, the essential condition

6. Diagram showing principle of push-feed mechanism.



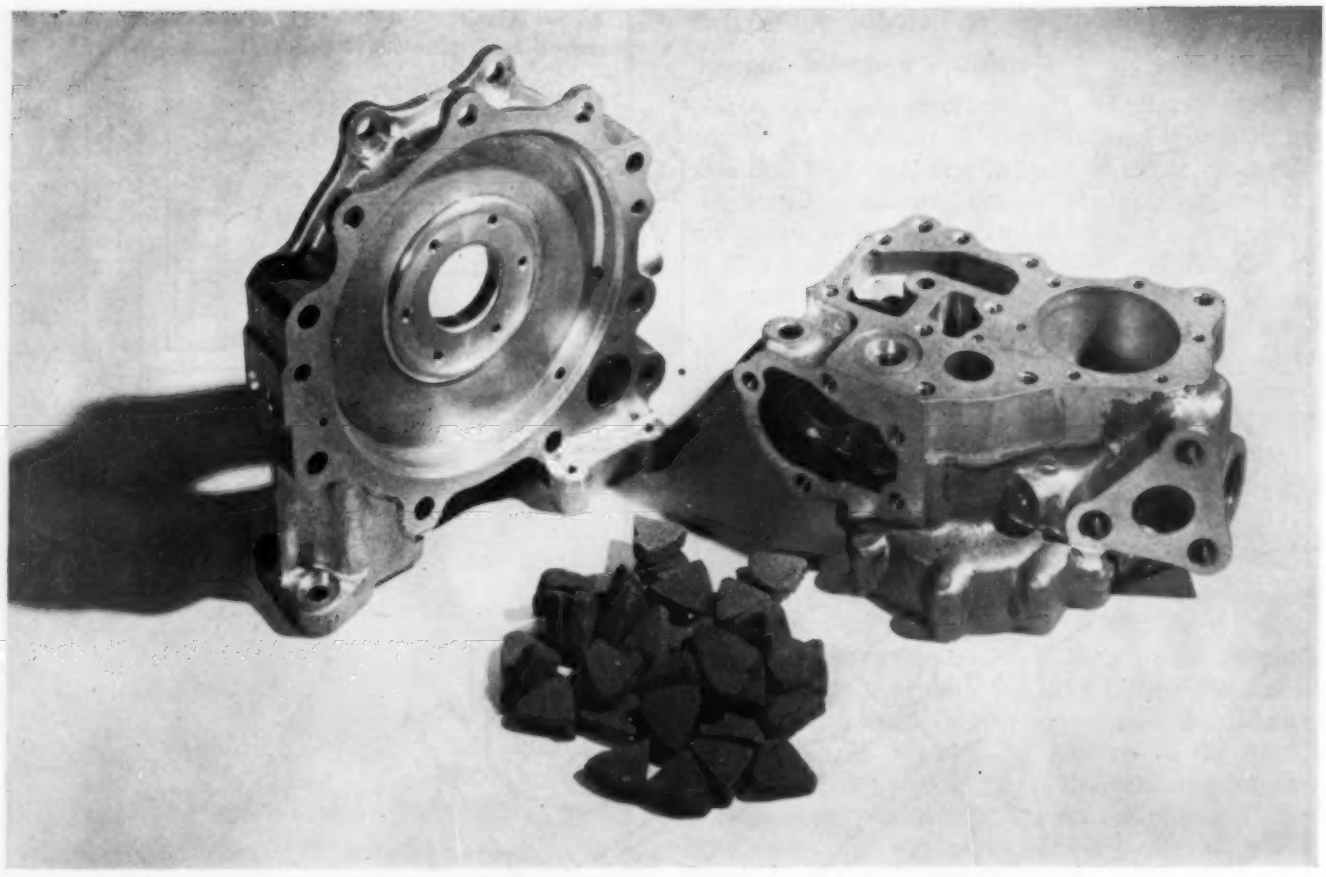


7. Diagram showing principle of selector hopper (and cone).

for the success of the hopper feeding is that the length of the piece shall be at least two and a half times its diameter. In this case, the hopper employed embodies a rotating disc operating at an angle of 45 degrees, and carrying a number of selector holes chamfered at the edges to receive the workpieces, figure 7. Attached to the disc are a couple of paddles, and the rotation of disc and paddles serves to churn and agitate the load of pieces continuously so that they may be presented in the correct position to drop into the holes in the rotating disc provided to receive them. The circle of selector holes in the disc passes over the inlet end of the chute leading into the push-feed mechanism.

In order that this chute may be always fully charged, the capacity of the hopper has to be considerably in excess of the grinding capacity of the machine. The inlet end of the chute is therefore provided with a by-pass device. When the chute is full the action of the rotary selector disc, in offering further workpieces, simply results in these excess workpieces being passed down the by-pass channel and back into the hopper.

In the case of the particular size of bicycle cone described, the stock removal is .005 in. to .008 in., the ball path has to be concentric about the axis within .003 in., and the automatic production is at the rate of 720 pieces per hour. ● ●



1. Triangularly shaped chips which eliminate wedging.

Precision Barrel Finishing: Types and Use of Media and Compounds

Part 3: Types and Use of Media and Compounds

● THE present day barrel finishing operator has a wide selection of media to choose from, at times so many that he becomes confused. With such a wide variety of parts being barrel finished and with each part having its own individual peculiarities and problems, there can be no truly universal medium. Each type has its own outstanding advantages for some purpose.

Chips

The most widely used media are the various types of chips or "stones" supplied either as natural or manufactured products. The most popular of the manufactured stones are either 100% aluminum oxide or a combination of aluminum oxide fused with a bonding material, the second being commonly known as a bonded chip.

Choice between these two aluminum oxide chips depends upon operating conditions. With everything else being equal, 100% aluminum oxide chips cut faster than the bonded chips. Apparently this happens because 100% chips "shell" more rapidly than the bonded type and, as in grinding wheel operations, some shelling is desirable to expose fresh cutting surfaces. The shelling also serves to release aluminum oxide "fines" which act similarly to the addition of an abrasive compound to the working load and which also help to refine the flat surfaces of the work being tumbled.

Bonded aluminum oxide chips, as they shell more slowly, retain their "screened" size longer, a factor which is of benefit where wedging problems are likely to be encountered because more runs can be made on a given part before rescreening of the chips is necessary. With both of these chips, as with any chip, a certain amount of variation in speed of cut is possible through the use of the proper compounds, adjustments in load height, water level, etc. This will be covered more completely in part four of this series.

Both types of chips often become loaded or glazed after a period of time so that their cutting rate declines rapidly. The rate at which this load-

ing or glazing takes place depends upon the conditions involved in the use of the chips. Continued runs at slow speed, high water level and long burnishing runs in soap base compounds will tend to accelerate the loading rate. As the chips become more and more glazed, their burnishing ability will improve, but their cutting ability will decrease. Detergent compounds or abrasive compounds used during the cutting cycle will help keep the chips open, but often the nature of the parts being processed demands a slow speed or a one-operation cycle with a burnishing compound, so that loading of the chips cannot be avoided.

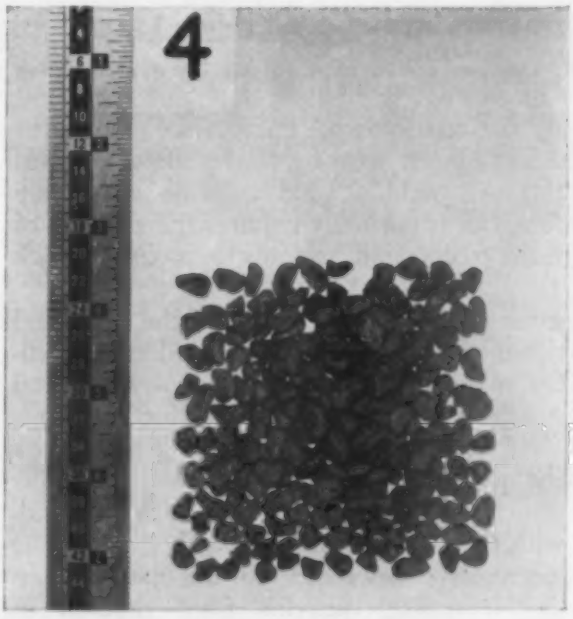
To expose fresh cutting surfaces or "open up" the chips again is relatively simple. The usual procedure is to tumble the chips dry at as fast a speed as possible for one to five hours depending upon the size of the chip and its loading condition. The purpose of this operation is to break open the crust of the chip. This should be followed by a short run with water and an alkaline detergent type compound to remove the fines or shellings from the chips and barrel.

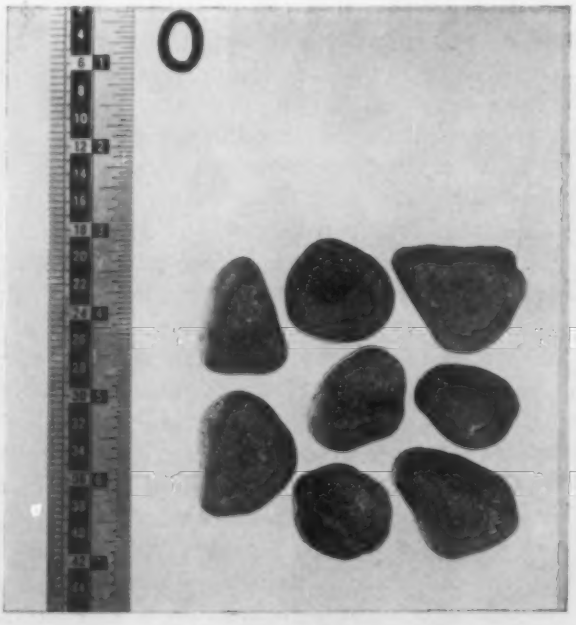
As far as relative cost between regular aluminum oxide chips and the bonded variety is concerned, the choice depends upon the parts being tumbled. The regular aluminum oxide chips cost less to purchase initially and cut more rapidly, but they do wear down more quickly. Therefore, the consumer must decide which is actually less expensive—a shorter time cycle or a longer lasting chip.

Of the natural chips, granite and limestone are

By **Morris S. Shipley,** President
and
William A. Biebel, Vice President
The Esbec Barrel Finishing Corp.
Byram, Conn.
(Formerly Tumbling Sales & Service Co.)

This is the third part of a five part series on Precision Barrel Finishing. The first part, September, dealt with limitations and applications; the second part, October, discussed the equipment required for barrel finishing. Parts four and five will appear in December and January.





2. Three different sizes of aluminum chips. The size of the chips is shown in the upper left hand corner of each photo. The overall size range is extensive, ranging from 00, which will pass through a 2-in. mesh and be retained on a screen with 1½-in. opening; down to U.S. Standard 12 mesh, which is very fine and is almost a grain rather than a chip. Between these two limits are eleven carefully graded sizes.

3. Left: Processed granite chips. Right: Processed limestone chips.

probably the best known. The granite chip is the hardest and longest wearing of the chips discussed here and will yield a good color in burnishing operations, but it normally requires the addition of an abrasive compound for any appreciable stock removal.

Limestone chips are the softest of the chips and wear down more rapidly, with considerable shelling. On many parts manufactured of soft metal such as copper, brass, aluminum or zinc, limestone chips yield a better color than other types. Their use with acidic compounds is usually avoided because the limestone tends to neutralize the acid, often with the evolution of gas.

A comparative newcomer to the natural chip field is Novaculite, quarried from deposits of Arkansas stone which has long been used in industry for honing purposes. This chip cuts more rapidly than the other natural chips, but yet is quite hard, with its effective life ranging between the granite and bonded aluminum oxide chip. Another interesting property of Arkansas stone is that when crushed, it fractures in very irregular shapes, thus presenting many sharp edges and corners which make possible the use of a larger size chip to break internal holes, slots, etc. without the wedging possibility encountered in the use of smaller sizes necessary to perform the same function with a "round" chip.

Probably the most important feature of Novaculite is that because it contains no aluminum oxide it cannot impregnate or "charge" parts being deburred. This is very helpful on electrical components and other parts where impregnation is detrimental. Because the chip is fast cutting, it is better for deburring such parts than other natural stones. Of course, an aluminum oxide abrasive compound should not be used in conjunction with Novaculite where it is important to avoid impregnation.

Chips, as crushed, cannot be made identical nor can they be screened to exact dimensions—only to a size range. Sometimes this dissimilarity in shape and size is beneficial because all sorts of radii and edges are present in the tumbling mass, but occasionally this results in wedging of the chips in holes and slots which can be very troublesome and costly. Controlled size abrasive shapes are appearing on the market in answer to the need for a faster cutting media which will reduce wedging problems. To date some of these shapes are the fastest cutting media available and show considerable promise since they can be eventually manufactured in different grit sizes and hardness. They come in triangular, rectangular, square and rounded shapes.

Steel and Other Metallic Shapes

For burnishing, hardened steel balls and shapes have long held supremacy for yielding the truest color and deeepest gloss of any media. On the softer metals, especially, they can be used to iron out surface irregularities while coloring, thus avoiding the necessity for a surface refining abrasive operation on many parts. For radius forming and burr removal operations, they are inferior to chips because of the tendency to peen or roll over burrs or sharp edges.

In many instances, they are used in conjunction with abrasive compounds before burnishing in the same media, but usually considerable difficulty is encountered in completely removing the traces of abrasive and restoring the physical and chemical cleanliness of the steel media necessary for high quality burnishing. Once a technique for such a cycle has been developed, it can be repeated, but considerable experimentation and know-how is necessary in first developing this cycle.

Hardened steel balls or shapes occasionally, and soft steel or zinc balls and shapes more often, answer the need for a controlled media size to eliminate wedging. When abrasive compound is added, the soft metals become impregnated with the abrasive and then act similarly to abrasive chips. Soft steel shapes are more popular than the zinc shapes because of longer life, cheaper initial cost and less

pressure formation when used in closed barrels. When used with the proper compounds, the soft media are often used to develop micro inch finishes as low as one to two micro.

Compounds

For the most efficient and highest quality barrel finishing, the compound is the most important item to be placed in the tumbling barrel. The purpose of the compound is to keep the media functioning most efficiently or to vary its cutting properties. It does this by setting up a chemical or chemical-abrasive bath within the tumbling barrel. The most common types of compounds are as follows:

a. Cleaners—consist of two general types, alkaline and acid. The alkaline cleaners must set up and maintain a safe pH (degree of acidity or alkalinity) in the solution to prevent rusting, pitting or other forms of corrosion on the metal being furnished. In addition, they should remove and keep in suspension oils and dirt introduced into the barrel with the parts as well as the shellings or cuttings from the media which will otherwise serve to load and glaze the medium which is to do the abrading. The cleaner must then aid in removing these contaminants from the mass during the rinsing cycle to make possible better burnishing, which normally follows cutting operations. For different metals the alkalinity of the compound is usually different to promote better color or to prevent alkali attack on the metals.

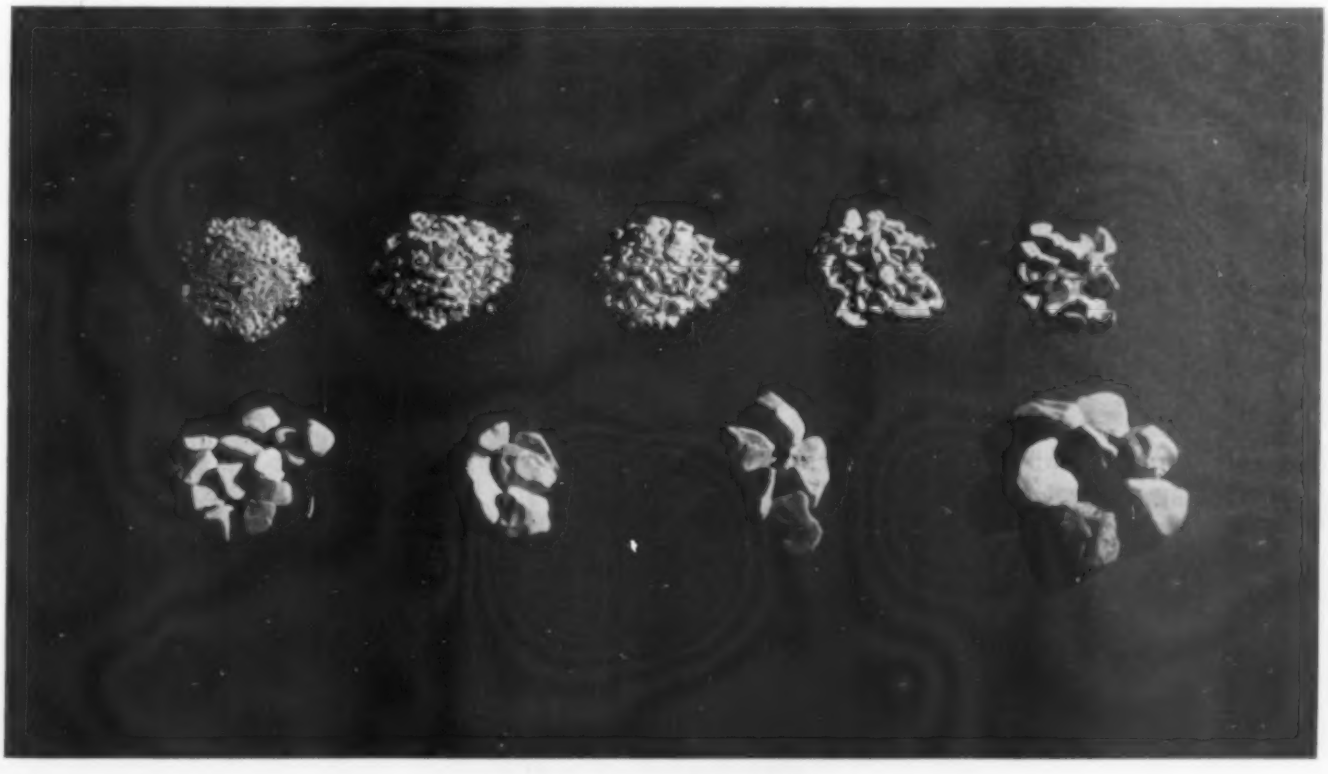
Acid cleaners have the same function except that these compounds are often used to remove heat treat scale, rust and other stains from the parts, instead of conventional pickling. This works out quite well because they can often be used with chips to provide a combination cut down run while the scale is being removed. In fact, nesting type or flat type parts can be descaled in a tumbling barrel better than by a dip method. Parts finished in this manner will always have a better finish and color than abrasive blasted parts or pickled parts.

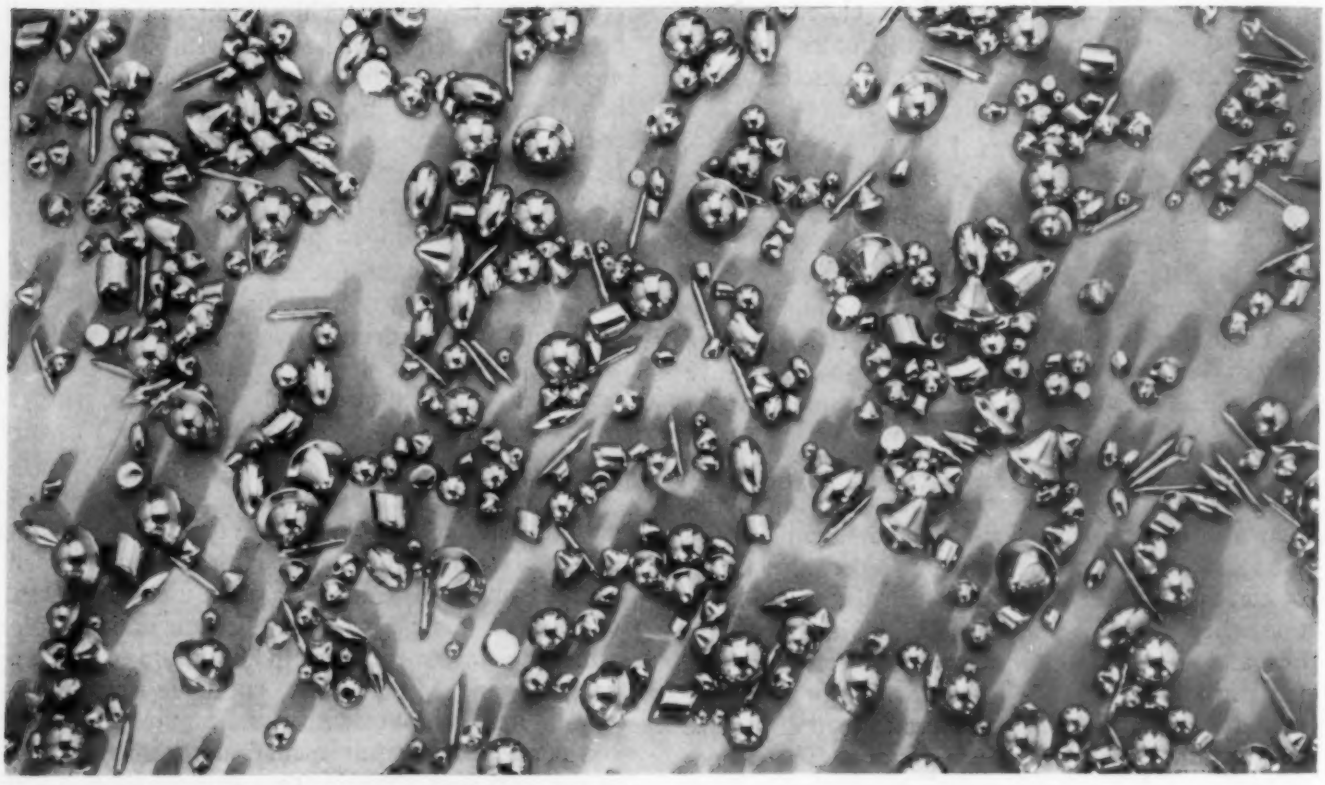
After using acid compounds on ferrous parts, however, the barrel must be quickly and thoroughly rinsed, as well as neutralized immediately with an alkaline compound, to prevent further action of the acid and to prevent traces of the acid from interfering with the soap base compound which usually follows this operation.

Often it will be found that acid cleaning compounds will remove the stubborn types of dirt, stains, or discolorations that burnishing compounds will not. Advantage of this fact is often used to "bleach" or brighten many parts which become dark in color after long cut down runs with aluminum oxide chips or compounds. In addition, cut-down-runs in aluminum oxide chips or with aluminum oxide abrasive compounds often result in charging or impregnation of the parts with abrasive. This impregnation in turn causes excessive tool or cutter wear in subsequent machining operations, reduction of conductivity of electrical components, or poor plating results. The acid cleaners are often used to remove this impregnation and make possible the satisfactory barrel finishing of the part in question.

Acid compounds should never be mixed with other cleaners or with cyanide.

4. Novaculite, natural Arkansas stone.





5. Different sizes and shapes of hardened steel burnishing media.

b. Abrasive compounds—consist of one or more types and/or grit sizes of abrasive grain compounded with various cleaners. Many tumbling or barrel finishing supply organizations have available a complete range of abrasive compounds which will either cut quickly and expend themselves by pulverizing to provide a progressively finer surface or be rugged enough to continue cutting until rinsed from the barrel. Abrasive compounds are added to non-cutting media such as steel slugs or to a non-cutting or slow cutting chip to provide the desired abrasion.

When added to aluminum oxide chips, the abrasive compounds provide extra refining of the "flats" or diameter of a given part, but they do not seem to contribute much to deburring or radius forming. This is indicated in figure 6. which demonstrates more clearly the effects of an abrasive compound.

For deburring or radius forming in aluminum oxide chips, a detergent type compound which keeps the chips open and free cutting is more economical to use than an abrasive compound. This is because the detergent type compounds are used in proportion to the amount of water (1-2 oz. per gallon) while the abrasive compounds are used in proportion to the volume of mass (6-10 oz. per cubic foot). This difference in ratio can mean the difference between two pounds of detergent compound against ten pounds of abrasive compound in a fairly large barrel and the cost is approximately the same per pound. However, an abrasive compound is necessary in self-tumbling or where surface abrading or refining is desired instead of, or in addition to, radius forming.

Micro inch finishing is accomplished through the use of one or more abrasive compounds. Usually the final abrasive compound is one which breaks down (pulverizes) to provide progressively finer abrasion. Surfaces of one to two microinches are being obtained on many parts in this manner with extraordinary savings when compared to former methods.

c. Burnishing compounds—are the most complex of the barrel finishing materials. The burnishing compound must establish and maintain the proper pH of the solution to prevent corrosion of the parts while the compound is doing its job of removing the dirt and oxides from the parts being finished. All dirt removed must also be held in suspension while the true metallic color of the part is being exposed and enhanced by developing a shine or gloss. In the past it was felt that the main function of the burnishing compound was to provide lubrication. Most burnishing compounds contain a rather large proportion of soap which does provide some lubrication but soap itself, except in special cases, will not do as satisfactory a job as a modern burnishing compound. It is becoming more and more apparent that the various cleaners, builders, water conditioners, etc. which go into a good burnishing compound play a more important part. This is especially true in working with chips where the parts can lose their natural color during a cut-down cycle. The need for restoring the color during a burnishing cycle has resulted in continually improved burnishing compounds.

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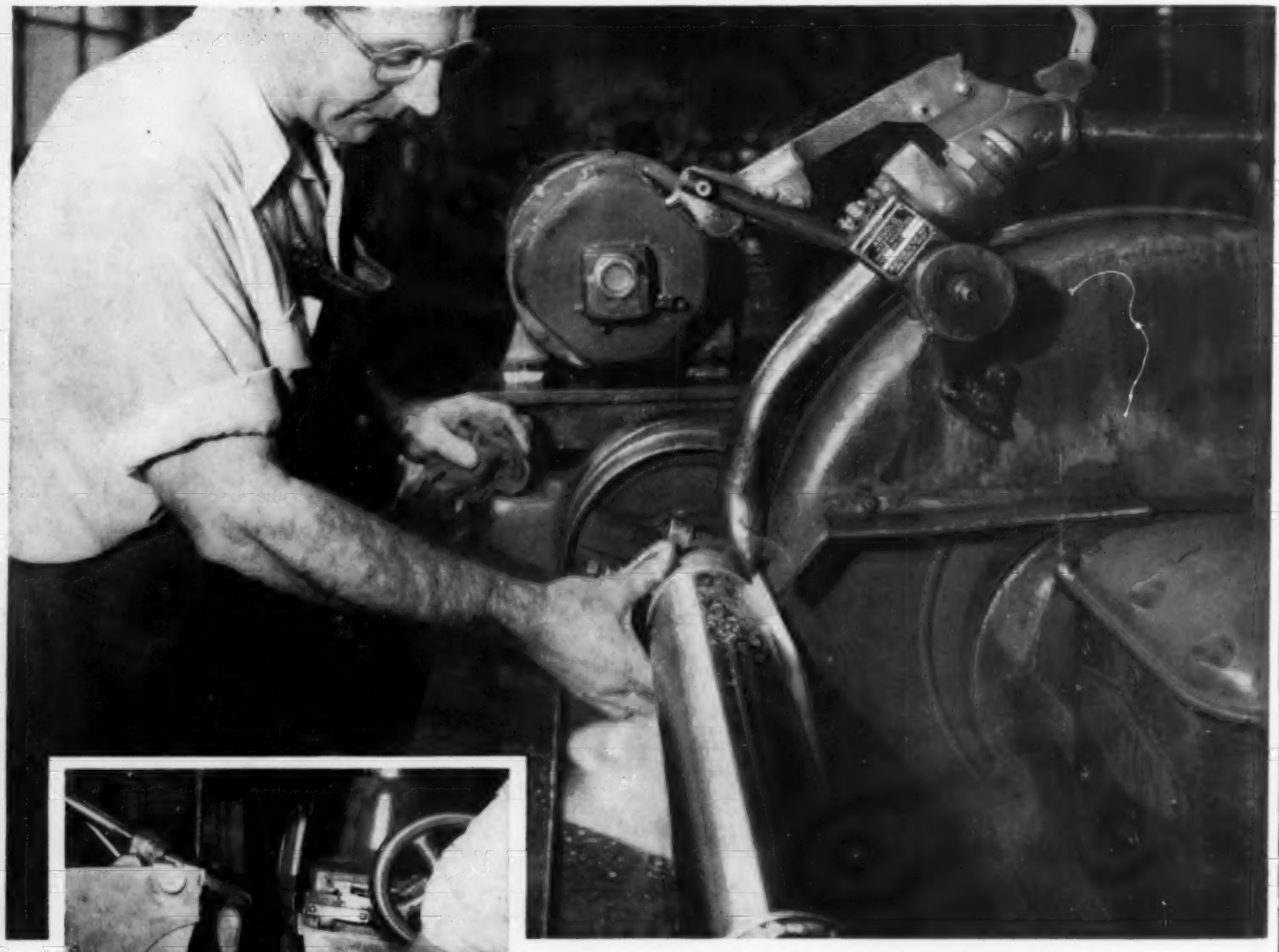

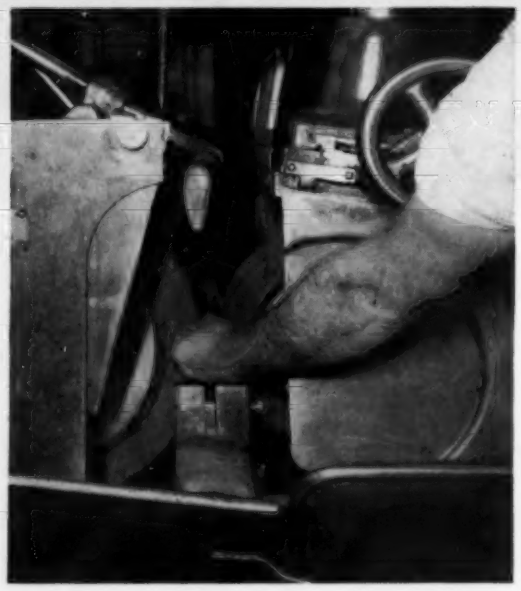

"***Production rate increased 35%*** by G Bond wheels, with a greatly improved finish," are two typical "Touch of Gold" advantages reported by the user performing this cylindrical grinding operation. Job calls for .025" stock removal from 1040 seamless steel tubing, with ⅛" wall. The machine is a Norton — a reminder that only Norton offers you such long experience in both grinding machines and wheels, to help you produce more at lower cost.

"***We now get 800 pieces per dress*** with Norton G Bond wheels, as against 500 pieces with previous wheels. Also, we get 50% more wheel life, a better finish, and the shoulder holds up much better." Those are the facts reported on this plunge-cut centerless grinding job. Work is a ¼" diameter x 1" long stud from which .012" stock is removed, to .0005" tolerance and 20 microinch finish.

Users tell how "TOUCH of GOLD" *performance boosts production rate, product quality and profits*

In many years, nothing has done as much to raise the standards of precision and semi-precision grinding as Norton G Bond wheels. In the field of O. D. grinding, for example, users all over the country report that these greatly advanced wheels have given them an entirely new slant on the profit-possibilities of their centerless and cylindrical grinding jobs.

Here we can illustrate and quote only a bare minimum of the very many enthusiastic endorsements that are pouring in. But you could sum them all up in this sentence: "G Bond wheels grind faster, finish better, last longer and save us money on every job."

The reason is, the Norton G Bond is by far the most efficient vitrified bond ever developed. Wheels made with it outperform all others of this type, with "Touch of Gold" advantages like these:

Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per dressing . . . longer wheel life . . . easier dressing, with less wear on diamond or on crushing roll.

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for proof of how G Bond wheels can help improve your products and cut your production costs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

Making better products . . . to make your products better

"***G Bond wheels last up to 40% longer,***" reports this centerless grinding customer. The piece is a vanadium alloy steel spindle ¼" diameter x 10" long, with a tapered shank — ground in a plunge cut which removes an average of .045". With G Bond they found that wheel life increased 30% to 40% because this greatly improved vitrified bond breaks down evenly.

"***100% better finish***" is just one of the advantages listed by this user who switched to G Bond wheels for cylindrical grinding of small diameter stock. And besides improvement in product quality, this firm reports 50% more pieces per dress, with the last piece ground before dressing showing every bit as good a finish as the first piece ground after dress — additional G Bond benefits adding up to "Touch of Gold" performance.

W-1606

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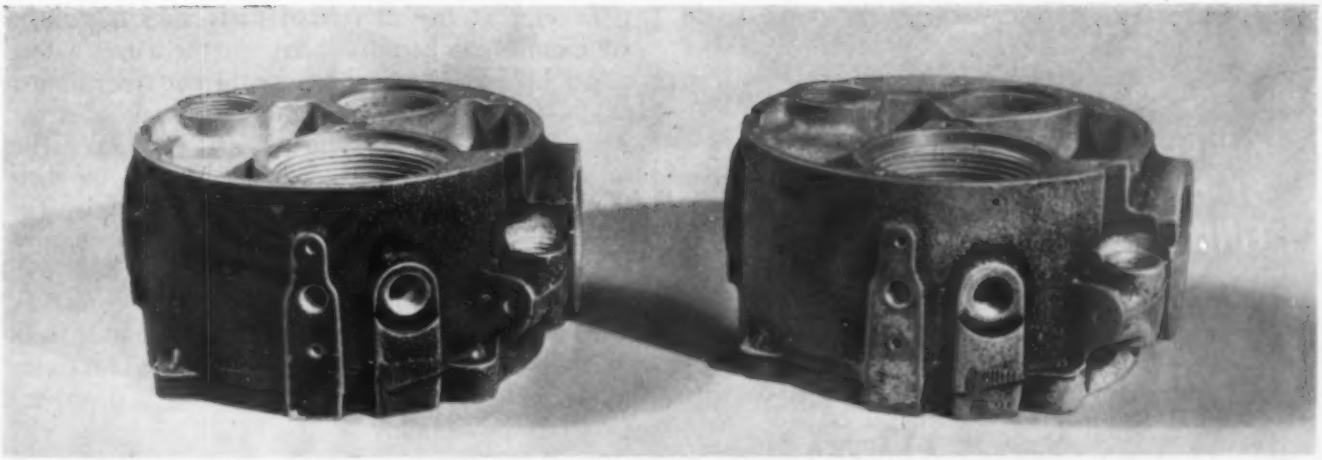

6. The photo illustrates the different results produced by a detergent compound and an abrasive compound when used with the same media.
For purposes of illustration, two identical parts were chemically blackened around the circumference, before barrel finishing. Both parts were processed identically—same chip and chip size, same barrel size and speed, same water level, etc.
The only difference was that the part on the left was processed with a detergent compound while the part on the right was processed with an abrasive compound.
The degree of edge break is practically identical, (although it may appear to be more on the left hand piece because of the contrast between light and dark areas).
The big difference is that the black surface on the right hand part has been removed to a very large degree by the abrasive compound, while it has been practically untouched on the part processed in a non-abrasive detergent compound.
This is a visual demonstration that if surface refinement is required, an abrasive compound should be added to the chips. Conversely, if edge break is desired without surface refinement, a non-abrasive detergent compound should be used.
NOTE: The part on the right has not been cleaned completely in the depressions as a large size chip was used to avoid wedging in threaded holes.

(Continued from page 32)

d. Rust proofing compounds—are basically two types, chemical or oil base. Often, after tumbling, the separating process is long and involved because of the nature or size of the part. For these operations, it is found better to rinse out the dirt-laden burnishing compound to prevent staining or darkening during the time the parts are to remain relatively motionless in the media.

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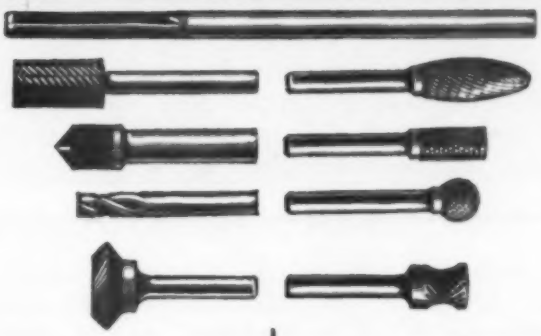

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To prevent rust of ferrous parts after this rinse, compounds can be introduced into the barrel with a new supply of water and run for three to five minutes to dissolve the compound and completely coat the parts. This method is also used to rust proof flat or nesting shaped parts which, because of their shape, cannot be effectively rust proofed by the dip method after separation. The most common of these compounds is a water soluble oil which will give about one month's protection against corrosion. In some instances the soluble oils might detract from the gloss or color of the parts and it is then necessary to use some other chemical compound to afford the necessary protection.

The writers feel that much more advantage can be taken of the water displacing oils after the completion of the barrel finishing cycle. Many ferrous parts are now being dried in sawdust or corn cob after which they are oiled for storage or for rust protection before the next operation. Such parts, unless perfectly flat or of a nesting shape, can be rinsed after the last operation and dipped into a water displacing oil. Such oils will remove the water from the parts and leave a film of controllable thickness for varying periods of rust protection. The water displaced from the wet parts sinks to the bottom of the dip tanks and is periodically drained off. The oil film on the parts can easily be removed by a dip method or can be made thin enough so that subsequent operations such as inspections, assembly, etc. can be performed without removing the film, and of course, the protection. At the same time, elimination of the sawdust or corn cob drying operation will eliminate expensive hand labor involved in loading, unloading, and separation of the parts from the drying media.

Part three has summarized the various materials used in barrel finishing; part four will discuss the actual steps involved in putting them to work to produce the desired results. ● ●

"So, having a wife will keep your nose to the grindstone! You could at least turn around!"

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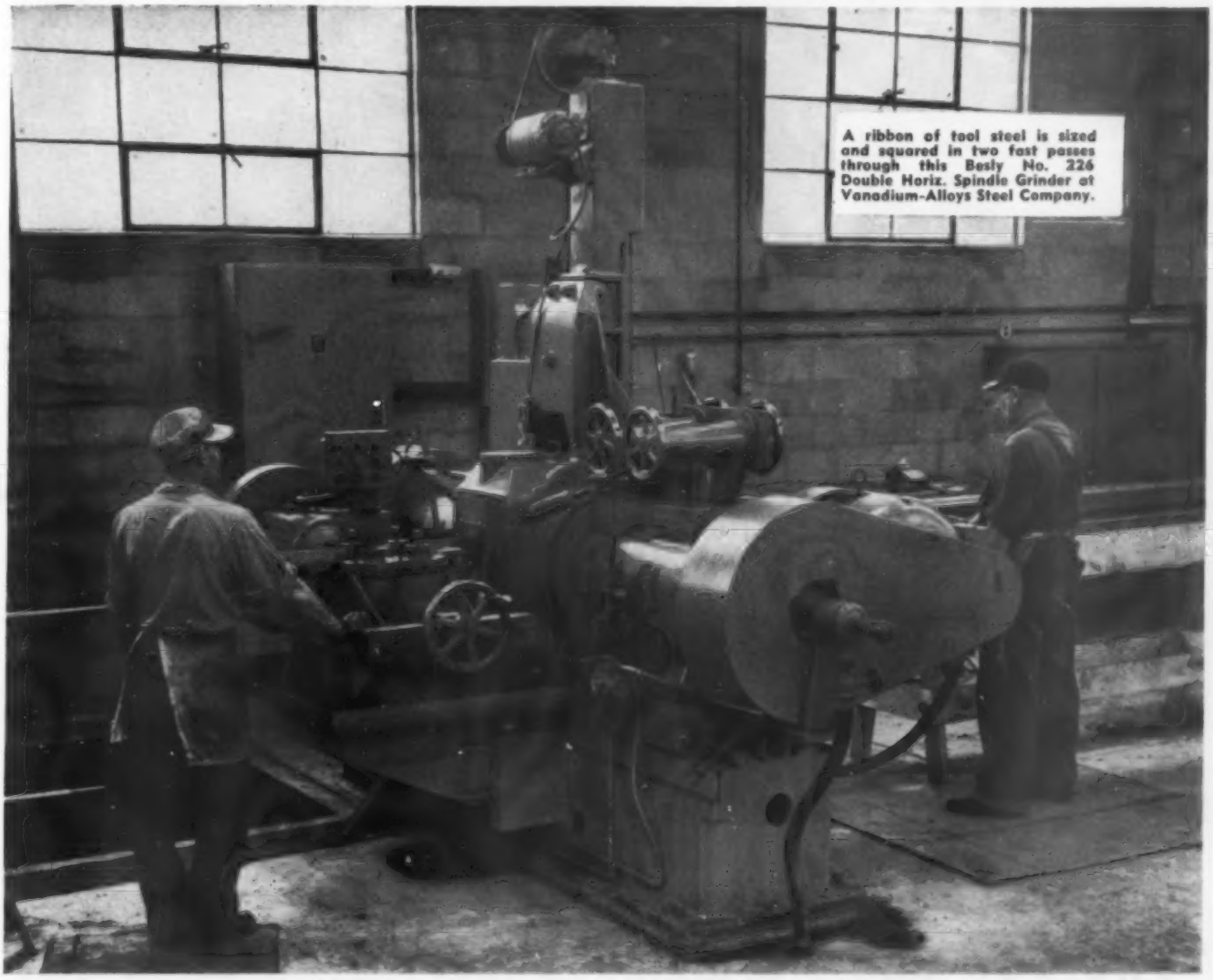
FROM BESLY-WELLES CORPORATION, BELOIT, WISCONSIN



A ribbon of tool steel is sized and squared in two fast passes through this Besly No. 226 Double Horiz. Spindle Grinder at Vanadium-Alloys Steel Company.

Besly Grinders Keep Tool Steel Bar Stock "On The Square"

The Double Horizontal Spindle Grinder shown installed at Vanadium-Alloys Steel Company, Latrobe, Pennsylvania is a good example of how many of the major tool steel companies in this country are using Besly Grinders for production finishing. This grinder sizes and squares all four sides of bar stock *in just two fast passes* through the machine. The grinder's two vertical parallel discs do the trick, simultaneously grinding two parallel surfaces of the bar stock on each pass.

Double disc grinding permits both high accuracy and fast metal removal on this job. Bars are held to ± .002" for size and .0015" for squareness (measured across corners) with as much as .025" of material being removed per pass from ¾" square bars.

The bar stock is fed in 12' lengths through the grinder by a rugged power-driven, roll-type feed unit which can be adjusted to handle bars from ¼" square to 3" square or equivalent rectangular shapes. Rate of feed is 12' per minute, but may be varied to conform with the grinding requirements of other types and sizes of stock.

Abrasive life is also improved by double disc grinding. The 30" Besly-Titan Discs used on this machine regularly remove over 900 pounds of tool steel each before replacement is necessary.

A tolerance can be held to ± .002" for size and .0015" for squareness at a grinding rate of 12' per minute.

SEE NEXT TWO PAGES for story of what Besly double disc grinding is doing for another prominent manufacturer.

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.

Automatic loading and discharge on these Besly No. 226 Grinders at prominent power steering manufacturing plant makes possible continuous production while operator checks finished pieces for .0005" tolerance.

"Two For One" Grinding Boosts Production For Power Steering Producer

Uses Besly Double Horizontal Spindle Grinders to Grind Two Surfaces in One Pass

Grinders Hold Size, Squareness and Parallelism as Close as .0005" at Production Rates as High as 18,000 Pieces per Shift

Power steering units are big business for one prominent automotive components manufacturer. Production runs into the hundreds of thousands of units every year, making efficiency at mass production rates a "must" for this precision manufactured product.

Modern grinding techniques play an important part in the manufacture of the power steering units since a number of the components must be close-fitting to minimize oil leakage and insure hydraulic efficiency. Tolerances as close as .0005" for size, squareness and parallelism are maintained on valve centering spindles and pump rotor vanes, for example.

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.

Besly Grinders at Power Steering Plant (Con't.)

Besly Grinders are used extensively in the production line to deliver this grinding accuracy at mass production rates. Some 33 Besly Grinders are in the plant and most are the Double Horizontal Spindle type which grind two parallel surfaces in one pass through the machine. Not only is output about twice the production of single disc machines, but accuracy and abrasive life are also improved by the twin disc method of grinding. Many of the Besly machines are fixtured for automatic loading and discharge, permitting continuous production while the operator loads hoppers, empties collection baskets and checks pieces for accuracy.

A new bulletin describing the complete line of Besly Double Horizontal Spindle Grinders for discs from 12″ to 72″ has just been published. It is available free on request.

SEND COUPON NEXT PAGE FOR BULLETIN 200

Grinds 18,000 of these on two sides every shift . . .

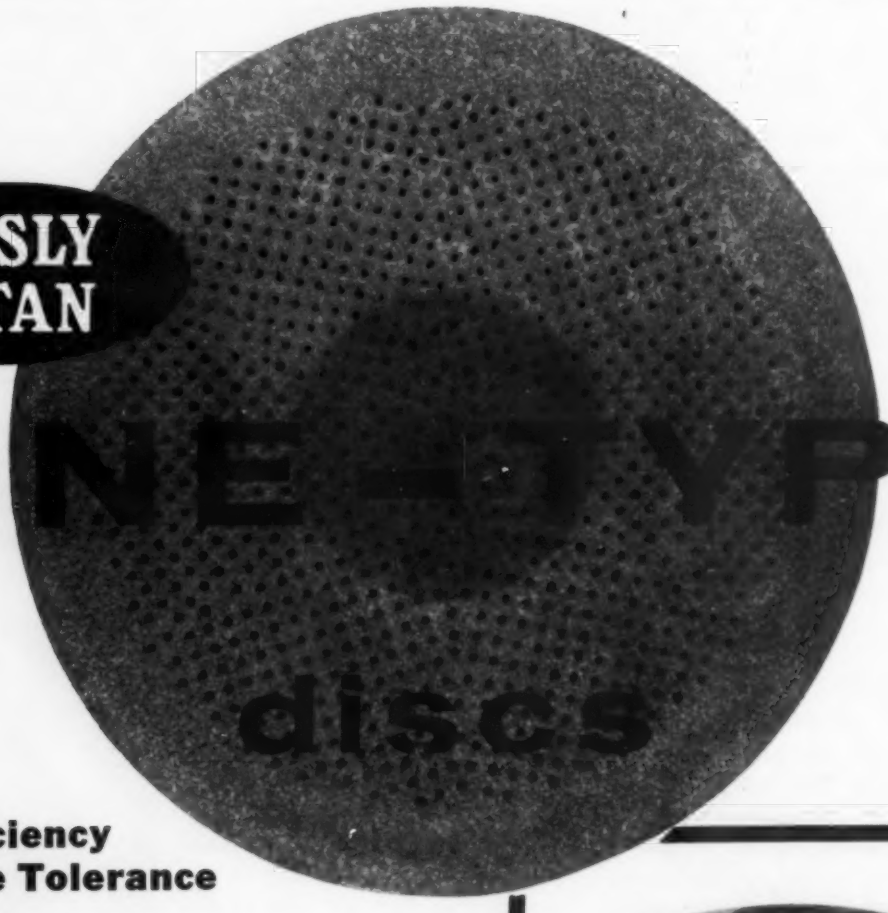
Pump rotor vanes shown at right are a part of the hydraulic pump in a power steering unit. Made of high speed tool steel (60-64 Rockwell on the "C" scale), they are ground to within .0005″ for thickness and parallelism in the pump vane grinding department pictured on the opposite page. The vanes are loaded into a hopper, automatically fed to a rotary feed wheel which carries them between the discs of a Besly No. 226 Double Horizontal Spindle Grinder. Grinding is done wet with coolant supplied to the work through the hollow spindles of the grinder and the center holes of the discs. After grinding, the vanes drop into a basket beneath the feed wheel. Approximately .010″ of material is removed from the vanes in two stages; .006″ in a rough grind and .004″ on the finish grind. Over 1,200,000 pieces are being ground in two stages in this four machine department every month. The 23 x 2½ x 10 Besly-Titan discs on the grinders are currently averaging 400,000 vanes before replacement is necessary. The discs are dressed once every shift.

Spindles are automatically fixtured for a fast grind here . . .

Hardened steel (Rockwell 50) valve centering spindles for power steering units are ground on both ends at the rate of 17,500 per shift on this Besly No. 226 Grinder. The feed mechanism is entirely automatic with spindles hopper-fed to a rotary feed wheel which automatically clamps them in place. After grinding, they are discharged from the feed wheel by an air jet. Grinding accuracy is .0005″ for size, squareness of the ends and parallelism. The grinder is equipped with Besly-Titan discs which are dressed on the average of two times per shift.

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, Beloit, Wisconsin.



Improve Abrasive Efficiency on Many Close Tolerance Grinding Jobs

Many grinding operations where close tolerances are required cannot efficiently be done with the standard one-hardness disc. Special treatment must be given to the inner portion of the disc to enable the user to get the best results from the entire width of face. In some cases, this means making the inner portion softer than the balance of the disc; other operations call for the outer portion being the softest.

Besly-Titan Resinoid Abrasive Discs are scientifically developed in any desired combination of zoned gradings to exactly meet the requirements of each individual grinding job.

Ask a Besly-Titan Abrasives Engineer to check your grinding department and see if a zone-type disc can improve performance. If it can, he will be glad to recommend the proper arrangement and grade of hard and soft areas for best grinding efficiency.

Discs with alternating sections of differing grain and hardness are beneficial on jobs where both hard and soft materials are ground, but where only one disc specification is wanted because of objection to down-time and change-over delays.

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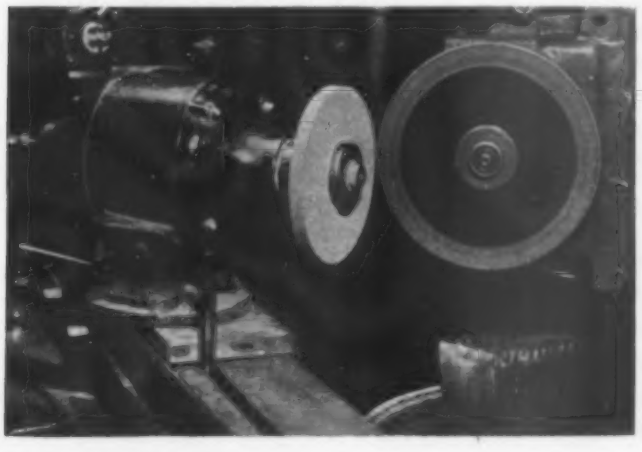
Tool and Cutter Grinding Department

A New Method of Dressing Diamond Wheels

By **Richard C. Bush,** Assistant Editor

Glenbard Tool Co., 216 N. Clinton St., Chicago, has come up with an unusual method of truing and dressing diamond wheels which promises great convenience and cost savings to the small shop. Glenbard produces special tools of many sizes and types, and in making carbide tools they use a variety of diamond wheels, including small mounted types. They knew that if a simple method of truing and dressing these diamond wheels within their own shop were available, there would be no need of sending the wheels back to the manufacturer for dressing, with the expense and trouble that this entailed.

Glenbard's completed setup for truing diamond wheels consists of a double-end 1/3 horse bench-grinder motor, mounted on a simple swivel base. The base is in turn bolted in the ways of one of

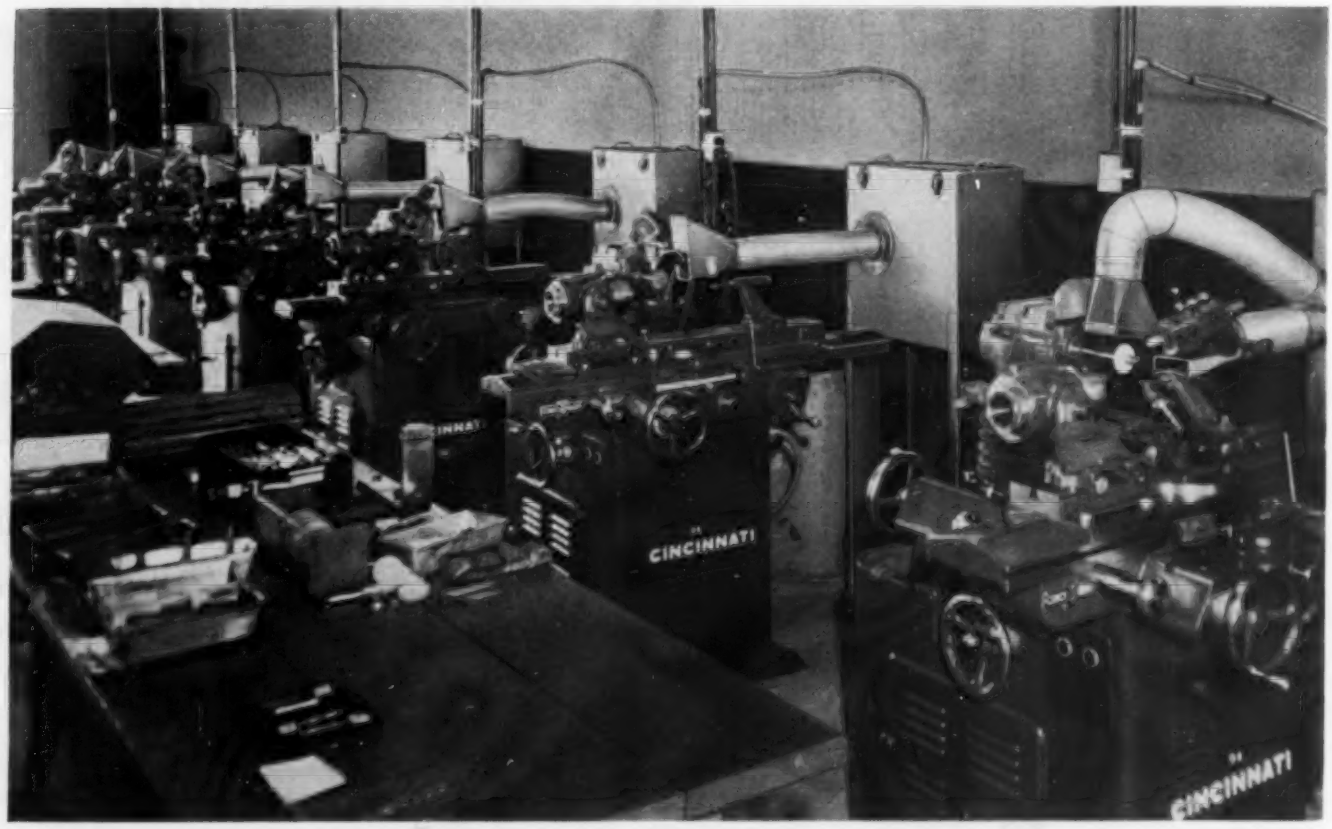


their Brown & Sharpe No. 13 universal and tool grinders. Any lathe, grinder, or tool post setup could be used with good results. See illustration below.

The dressing wheel is the important thing. Developed by Chicago Wheel & Manufacturing Co. in cooperation with Glenbard, it is a Chicago 49 CG 120 KV 79-K, and it can be used for truing and dressing diamond wheels of resin bonded, metallic bonded, or vitrified bonded types. Other wheel manufacturers have wheels of similar specifications. The particular wheel in the Glenbard setup is a 6 x ½ x 1¼, centered level with the diamond wheel being dressed. The wheels are rotated in opposing directions, the diamond wheel at 3545 rpm and the dressing wheel at 3450 rpm. Glenbard indicated that slower dressing wheel speeds should also give excellent results.

The swivel base on the dressing motor permits dressing any angle on the diamond wheels. An interesting application Glenbard makes of this feature is the forming of small special-shape mounted wheels from more inexpensive plain wheels. ● ●

Chooses Unit Dust Collectors Over Central System for Seven Universal Grinders



Producer of precision custom made taps selects seven dust collectors to collect the dust from these seven Cincinnati universal grinders rather than a single collector for entire lot. Extremely intermittent use of grinders, with the savings in installation time and subsequent operating power prompted this selection.

The selection of equipment is often a very simple, very non-technical operation.

An example of this is the installation of collectors to collect the dust from seven Cincinnati grinders in the shop of a leading producer of precision taps. The management of this shop refers to itself as a "job-shop" in that it welcomes orders for special taps in lots of one or two taps as well as in the larger production lots. This means that the use of the seven grinders is on a strictly intermittent basis with the total usage throughout the day being completely unpredictable. Yet these grinders were installed in a row along one wall of the shop which made it appear at a glance that all could be tied into a single system.

The single system collector which would handle all seven grinders was available from the same dust control manufacturer that could also offer individual one-per-grinder unit type collectors. Moreover, the single collector was available as a standard stock pre-

tested unit, the same as the small unit-type collectors. The problem was quickly broken down into its essential elements somewhat as follows:

The amount of air required right at the source of dust totaled about 3,000 cfm. Since the plant is located in the far northern zone where low winter temperatures prevail over a longer period of the year, it was mandatory that the cleaned air be returned to the interior of the shop rather than wasted to the out-of-doors.

Because of the location and also to avoid interfering with current production, the customer decided that his own maintenance department would install whichever system was decided on.

The centralized system

One single self-contained dust collector with cyclone separator and second stage filter to permit return of the cleaned air to the working space would be installed at the end of the row of grinders. A conventional header pipe would connect to the inlet of the collector and have branches and vertical droppers to connect with the hood at each grinder. The vertical dropper has a decided advantage when the universal feature of this type of grinder is being used as it permits the hood to follow the positioning of the grinding wheel to any position. In the present instance, however, the universal feature of the grinder would never be used—the grinding would all be done in one position. Thus the vertical connection had no advantage over a horizontal pipe.

The removal of the collected dust, the regular shakedown of the filter, and renewal of the filter on the collector would depend on the total hours the grinders were in use, but there would be only one collector to maintain. Whereas on the basis of installing one collector per grinder, the maintenance would have to be repeated for all seven collectors. Insofar as installation of the single system was concerned, it would be supplied with installation drawing and all parts would bear a number to correspond with the part, thereby permitting the assembly of the piping and the installation of the entire system to be done quickly by unskilled workers.

The advantage of seven separate collectors

The unit "one-per-grinder" type of collector is likewise entirely self-contained in that each has its own cyclone separator and second stage filter to permit return of the cleaned air to the shop. Installation would consist of moving the collector into position behind each grinder and fastening a short section of connecting hose—with its hood—to the inlet of the collector. By putting the collectors on stands, the surface friction losses would be reduced to virtually nothing. The collectors could be installed with the least interruption to normal operations.

Maintenance of the unit collectors—shakedown of the filters and removal of the dust—appeared to loom large until it was agreed that each grinder

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operator would give his collector a "morning shakedown" before starting the grinder. The collectors would be installed in stands; this would somewhat facilitate removal of the collected dust from each unit.

The decision in favor of the unit type collectors was made, however, chiefly on the point of the intermittent usage of the grinders: If only one single grinder were being used, the 7½ hp motor of the single collector would be running. But in the case of the individual collectors only a 1/3 hp motor would be "on." With all seven grinders in use, the electrical power required would be on the basis of 7½ hp for the single system as compared with 2 1/3 hp for the individual unit type collectors.

The possibility also existed that the arrangement of the grinders might someday be changed, or that more grinders would be added. The cost of the individual unit type collector was only a little above the cost of the single large collector with its overhead piping and branches so the management felt that the advantages were worth the difference.

As it has worked out, the maintenance of the individual collectors has been much easier than was even expected. The "morning shakedown" has become something of a ritual with one operator trying to "outcrank" his neighbor in speed and effect. The life of the filters under this system has been ten months rather than the anticipated six months, and the collectors protect the health of the workers, the precision machinery used in the shop, and also the accuracy of the finished taps.

The unit type collectors finally selected are Model 520 Dustkops rated at about 500 c.f.m. The single large collector which normally would have been used is the Model 3050 Dustkop, and is rated at 3,600 c.f.m. They are made by Aget Mfg. Co., 1380 E. Church St., Adrian, Mich. ● ●

"It must be the magnetic chuck on that surface grinder downstairs."

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Five Houdaille Magnetic Separators—mounted on grinder sumps—provide machines with a constant supply of clean coolant. Separator shown at left removes 62 pounds of ferrous metal chips and sludge daily.

Annual savings in coolant and maintenance costs total $2,230. Other benefits include longer wheel life, better product finish, more sanitary working conditions.

Write for Equipment Bulletin 601 and 4-page Leland case history.

*The Leland Electric Company—Division of American Machine & Foundry Company, Dayton, Ohio—is a leading manufacturer of electric motors.

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Shop Hints and Short Cuts

A Temporary Form Cutter Uses Abrasive

A temporary type form cutter costing $32.50 was developed at Douglas Long Beach Division for interim use while awaiting delivery of a regular metal form cutter. The temporary cutter kept production rolling in a critical period and produced parts to blue print tolerances.

Made to operate on a standard horizontal milling machine, the cutter form ground ⅛-in. No. 8 AMPCO bronze inserted in plastic to 1½-in. radius and 12-in. diameter.

The cutter is a laminated birch plywood disc four inches thick and 12-in. in diameter with a contoured face of 1½-in. radius. Cycle-weld C-14 was used to bond No. 60 grit abrasive to the cutting face. Four inch diameter x ½-in. CRS clamping washers were used next to the laminate and a 3-in. diameter wheel dressing gage prepared the cutting surface.

The form cutter was run at 250 rpm with Pemco as the coolant. The clean-up cut was made dry at 125 rpm, using air to clean the working surfaces of the wheel. ● ●

Do you use short cuts in your work? Do you have any kinks which would be helpful to the next fellow? Send them to GRINDING and FINISHING for publication. All material is paid for! Material can be in your own words, drawings can be rough pencil sketches; our editorial and art departments will do the rest. Send your Hints and Kinks to: Editor, GRINDING and FINISHING, 222 E. Willow Ave., Wheaton, Ill.

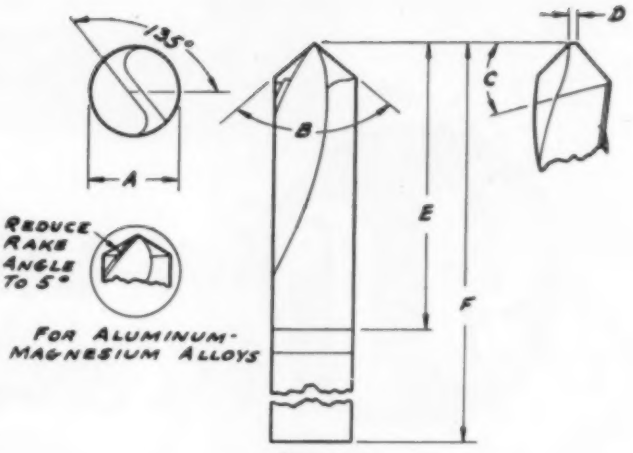
Drill Grinds Controlled

By **Edward McIntyre**

With the advent of relatively new materials into the industrial world, especially that field devoted to aircraft and aircraft instrument fabrication, controlled drill grind geometry is more important than ever before. High production demands of drills not only that they cut, but that they cut maximum surface feet—maximum surface feet spells selected and developed drill-point geometry. Carefully selected and controlled drill grind quickly pays for the method of control.

The sketch demonstrates a method of control and identification that is simple, flexible and easy to maintain. It can be set up in size increments to show and maintain proper grinds for plastics, investment castings, nitralloy, Armco iron, etc.

The day of grabbing up just any drill because it is the right size is gone. •



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TOOL NO.	A	B	C	D	E	F	SPIRAL	MATERIAL
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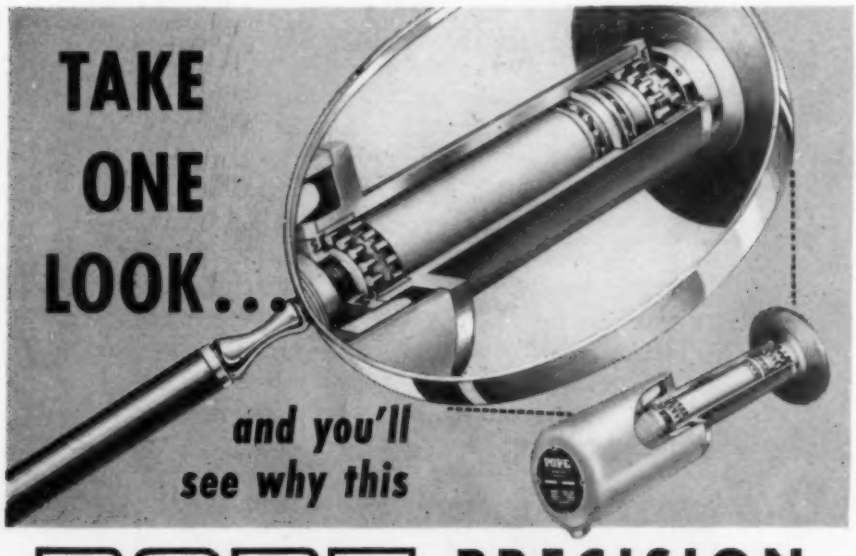
STD.250-01	21/64	140°	6°	.041	STD.	STD.	STD.	
STD.250-02	761/7442	120°	18-15°	STD.	STD. MACH.	STD. MACH.	STD.	ALUM. S.C.



POPE PRECISION SPINDLE

means finer finishes at lower cost

Look at the super precision double row cylindrical roller bearings and separate thrust bearings, an exclusive feature found only in Pope Spindles.

You won't find bearings like these in other makes of spindles.

The bearings and shafts in Pope Spindles have tremendous load carrying capacity for crush dressing and form grinding. They produce superior, low micro-inch finishes, and assure long, trouble-free operation. There can be *no endwise movement of shafts in either direction.* Operation is always cool. Pope System lubrication is good for the life of the bearings.

YOU CAN SPECIFY POPE SPINDLES WITH CONFIDENCE

Write for Catalog 60A covering the complete range from 1 HP to 15 HP in standard Pope Spindles.

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Specify POPE PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

BUILDERS OF THE REVOLUTIONARY NEW POPE SUPER-PRECISION BORING MACHINE THAT BORES HOLES ROUND WITHIN MILLIONTHS OF AN INCH

Encircle No. 219 on postpaid card

Grinding Fixture Features Speed and Accuracy

By **Walter Strike,** Tool Engineer

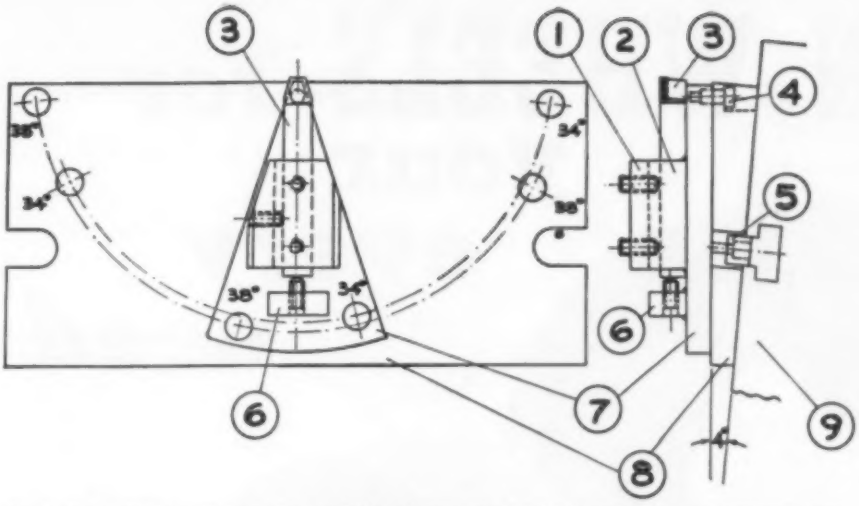
The illustration shown here pictures an index grinding fixture for carbide sheave tools, tools which cut the vee-grooves into vee-belt pulleys. The fixture was designed for extreme accuracy of the tools' cutting angle and for quick action. The idea on which this design is based can well be used for the sharpening of other types of special cutting tools, carbide or others.

Two sizes of cutting angles are accommodated in this fixture: 34 degrees and 38 degrees included angle. The tool (3) is placed beneath a clamp bar (1) which is welded on top of two uprights (2). The tool is forced against the right upright by a screw within the left upright. End adjustment is made by a screw that is anchored in a third welded to slide (7) which is hinged upright (6). All three uprights are to the base (8) by shoulder bolt (4).

Two index holes, one for 34 degrees and the other for 38 degrees, are in the slide (7). These holes are on circles of different radii to prevent errors by the operator. The base plate (8) has three sets of index holes, three holes for each angle. They are calculated to permit the grinding of all three cutting edges of the tool without readjustment of the grinding wheel or grinder table (9).

An index pin (not shown) determines the correct position of the slide in relation to the base and a small shoe-type clamp (not shown) can serve to hold the slide to the base in each position.

The end relief angle and the side relief angles of both types of tools, in this case, was 4 degrees and therefore



An index grinding fixture for carbide sheave tools which cut the vee grooves into vee-belt pulleys.

the bottom of the base (8) was machined at 4 degrees with the top of the base. •

Using an Adjustable Parallel As a Lap

By **H. J. Gerber**

I have found that the common adjustable parallel makes a superb precision lap for the very accurate finishing to size of hardened and ground snap gages.

These parallels, which are sold by several of the instrument making firms, are usually made of cast iron and consist of two tapered and interlocking halves. They can be set and locked at an infinite number of sizes within the capacity range of the particular parallel.

In using the parallel I first set it up on the surface grinder and regrind the two opposite edges to insure perfect parallelism. I then adjust the parallel to a snug fit in the snap gage opening and apply a small amount of very fine lapping compound. The lap is then moved in a reciprocating motion through the opening of the gage. As this opening begins to enlarge the lap will have to be readjusted to maintain the snugness of fit. Size measurements of the opening may be made by micrometer measurement of the tightly fitted lap or by directly measuring the gage opening with size blocks.

As these parallels are usually made of cast iron they are ideal as a lap and will be found to readily charge themselves as the lapping proceeds. It is good practice to use only enough compound to charge the lap and then wash it in benzine before taking off the last few "tenths". I have sometimes used "Bon Ami" powder for final size and a fine bright finish on very accurate gages. •

Adjustable parallel being checked for size. Snap gage and lapping compound.

We buy surplus diamond wheels and tools, also diamond wheel stubs and sludges. Highest prices paid.

NATIONAL DIOCHEMICAL COMPANY
3106 W. LAKE ST. CHICAGO 12, ILL.

They've got the Tenacity of a BULLDOG!

HOLLAND **PERMANENT MAGNETIC JUNIOR CHUCKS**

- Use 'em as bench tools for holding small, medium or large pieces for hand finishing, such as polishing, scraping, filing, etc.
- Use 'em for wet or dry grinding rows of small to large parts.
- Use 'em on surface plates . . . For testing and inspection purposes.

Eliminate clamps and vises... Won't mar work or interfere with tools

Readily portable with all steel body, ground top and bottom, flat and parallel, these chuck blocks contain multiple pole brass spacers. They can't heat to cause work distortion because they require no electric current. *Work is laid end-to-end over the pole spacers and held in a "bulldog" grip when knob is in ON position. Turn OFF for release.*

HOLLAND PERMANENT MAGNETIC JUNIOR CHUCKS

No.	Depth of Vee	Lines of Force	Dimensions Height — Length Width	Price Per Pair	Price Singly
A-1			2-1/16" x 1-7/8" x 1-1/2"	$42.00	$22.50
A-2	7/16"		2-1/4" x 1-7/8" x 1-1/2"	45.00	25.00
A-5	1/4"		2-1/16" x 1-7/8" x 1-1/2"	45.00	25.00
D-1 30°			Height – Base Leg – Width 4-1/4" x 2-5/8" x 1-3/4"	55.00	30.00

No.	Lines of Force	Dimensions Height-Base Leg – Width	Price Per Pair	Price Singly
D-2 45°		3" x 3" x 1-5/8"	$55.00	$30.00
D-3 60°		3" x 4-7/8" x 1-5/8"	55.00	30.00
B-1 Magnetic Pull top & bottom		1-7/8" x 2" x 2"	45.00	25.00

Two different blocks may be ordered at the PAIR Price.

Send your order now! Immediate delivery! Write for our latest bulletins on specially priced all new tools including permanent magnetic chucks!

DeWitt **DE WITT EQUIPMENT CORPORATION**
190 ELIZABETH AVE., NEWARK 6, N. J.

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MACKLIN WHEELS *for your every need*

MACKLIN has long had the reputation for producing the highest quality grinding wheels for all types of production and specialized grinding requirements. Macklin's contributions to the general improvement of grinding wheels in their twenty-eight year history have been many.

The latest, the patented and proved M M process bids well to be one of the greatest single improvements of all time. The unique construction of this new wheel with its self dressing qualities makes it a must on those difficult jobs that have been causing you trouble.

Regardless of what your grinding problem may be, or even though you may not feel that you have a problem, you owe it to yourself to fully investigate how Macklin can assist you in improving your grinding costs.

Call your Macklin distributor or factory man today.

Write for complete information to Dept. 65

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS AND OTHER ABRASIVE PRODUCTS

JACKSON, MICHIGAN

Encircle No. 221 on postpaid card

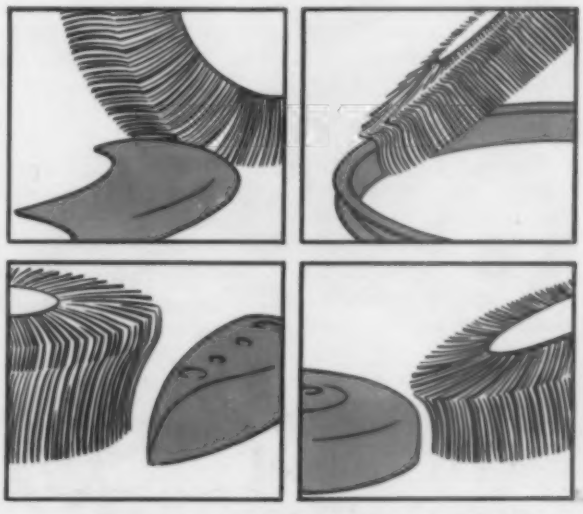
Now! 3M Introduces the "PG" Wheel

Obsoletes all other known methods for polishing and buffing contoured and flat surfaces prior to plating, painting or developing architectural finishes

The amazing new "PG" Wheel is a revolutionary new concept in coated abrasives application—the most significant development in the polishing field in the last 15 years. It reduces costs, increases production, improves finishes.

The "PG" Wheel—formed of over 1000 segments of cloth-backed 3M Coated Abrasive—is *self-conforming* and retains its shape throughout its working life. It requires *no* "breaking in" or dressing. It performs *all* the jobs formerly done by such methods as set-up wheels, sisal buffs, and rag buffs, yet also removes stock, if desired—features which no other coated abrasive on the market today can equal.

Installations in many plants have demonstrated that its production life is almost unbelievable. For example, in one plant a "PG" Wheel lasted 35 *hours* compared to a maximum of *15 to 20 minutes* for set-up wheels performing the same operation. At this same installation, where several "PG" Wheels turning at different RPM's were tested, the *lowest* "PG" Wheel life was 13 hours.



See "PG" Wheel Production Reports on following pages

"PG" WHEELS polish the entire inside area of Schwinn bicycle wheel rims. Fixtures holding rims revolve at 16 RPM on the rotary automatic machine. Dwell time at each grinding station is 10 seconds.

"Impossible" polishing job solved with "PG" Wheels!

Polishing the complete inside rims of 10-10 cold-rolled carbon steel bicycle rims was formerly an impossible job for the Arnold Schwinn Company of Chicago. This nationally known manufacturer was using set-up wheels and sisal buff wheels to blend flash weld on the rims, but was unable to polish them completely prior to plating.

Recently, this company tested 3M's amazing new "PG" Wheels on a rotary automatic machine. They found that three "PG" Wheels—a Grit 220 and Grit 240 Three-M-ite Resin Bond and a Grit 320 Tri-M-ite Resinite—perform the *whole* operation formerly done with set-up wheels and sisal buffs, *and* completely polish the inside wheel rim.

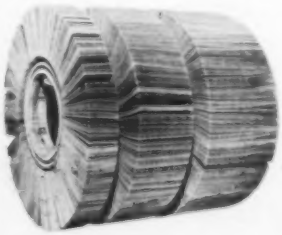
"PG" WHEEL conforms itself to sharp contours. It exposes fresh grain as it wears—will retain its shape throughout the entire life of the loading.

"PG" Wheel specifications

Available in Three-M-ite Resin Bond Cloth and Tri-M-ite Resinite Cloth

Diameters:.....14", 15", 16", 17"
Widths:.....2", 3", 4", 5", 6" *
Grits:.....#150 to #320

*for widths greater than 6", "PG" Wheels may be ganged for desired width.



"PG" WHEELS on an automatic straight line machine produce a 4 R.M.S. finish on auto bumper guards. Each "PG" Wheel polishes an average of 11,000 guards—lasts far in excess of an 8-hour shift.

"PG" Wheels increase production 80%

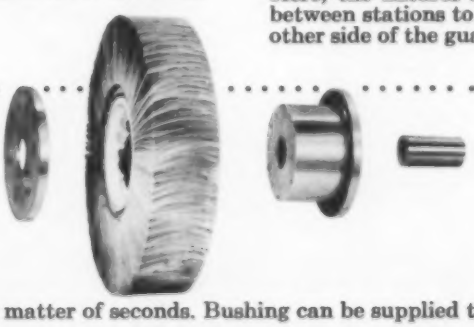
Oakman Plating Co., of Detroit, Michigan polishes cold-rolled steel auto bumper guards prior to plating. Its former method, using 12 set-up wheels and 8 sisal buffs, produced 2500 units per 8-hour shift with a 5 to 6 micro-inch finish. Set-up wheels seldom lasted more than *20 minutes* on the job before having to be replaced.

A 3M Engineer suggested that a test be made with "PG" Wheels. It was found that 13 "PG" Wheels of various grits replaced *all* set-up wheels and buffs—produced a 4 to 5 micro-inch finish—and increased production to *4500 units per 8-hour shift!*

Reason for this amazing production increase is that each "PG" Wheel lasts for several 8-hour shifts—down-time to replace set-up wheels is eliminated. Too, because of the better finish obtained with "PG" Wheels, the bumper guards' ultimate plated finish is far superior.

Here, the fixtures holding bumper guards turn over between stations to permit "PG" Wheel to polish the other side of the guard.

"PG" Wheel Assembly



FLANGE
WHEEL
HUB
BUSHING

3M's new "PG" Wheel can be assembled in a matter of seconds. Bushing can be supplied to fit any size drive spindle.

"PG" Wheel Production Reports . . .

Unity Manufacturing Co.,
Chicago, Illinois

PRODUCT: Deep-drawn brass spotlight shells and steel foglight shells.

OPERATION: Remove draw marks, and scale, and polish over-all surface prior to plating.

PREVIOUS METHOD: Backstand belts, Grits 220 & 280, over entire surface.

3M METHOD: "PG" Wheel replaces #280 belt. Production costs lower. Greatly improved pre-plated surface. Ultimate appearance after plating: far superior.

Houdaille Hershey, Decatur, Illinois

PRODUCT: High quality automobile bumper guards.

OPERATION: Polishing over-all surface prior to plating.

3M METHOD: With the "PG" Wheel the quality of the bumper guard was greatly improved and this company is now obtaining far superior plated surfaces.

Houdaille Hershey, Huntington, West Virginia

PRODUCT: Automobile bumpers.

OPERATION: Polishing contoured ends prior to bright nickel plating.

3M METHOD: With "PG" Wheels, the finish on the pre-plated surface was greatly improved, permitting a higher quality plated surface on the finished bumper.

Send coupon TODAY for full facts!

Minnesota Mining and Mfg. Co.
Dept. IU-115, St. Paul 6, Minn.

☐ Send me case history reports on the "PG" Wheel

☐ Please have 3M Representative call

Name.....

Title.....

Company.....

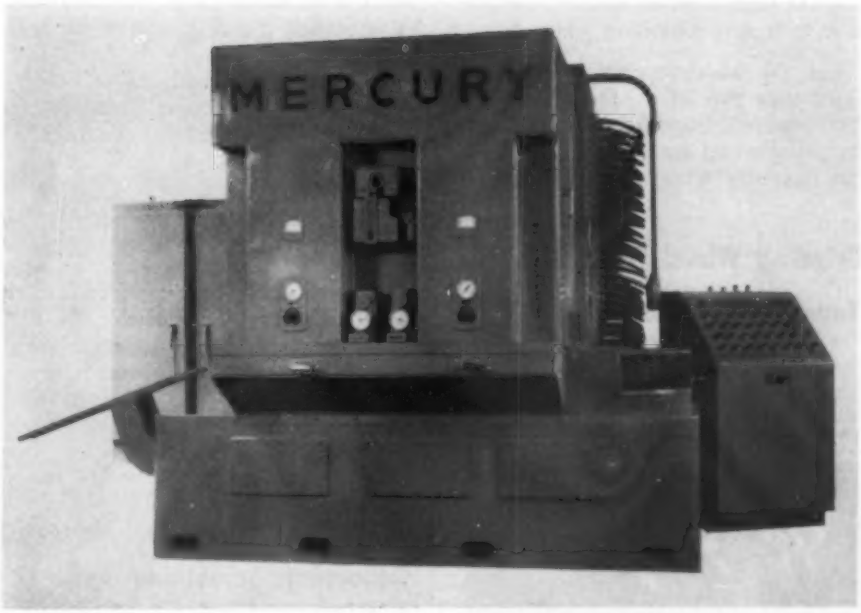
Address.....

City.....Zone...State.....

PRODUCT OF 3M RESEARCH

3M® ABRASIVES

Made in U.S.A. by Minnesota Mining and Mfg. Co. General Offices: St. Paul 6, Minn. In Canada: P.O. Box 757, London, Ontario. Export Sales Office: 99 Park Avenue, New York City. Makers of "SCOTCH" Brand Pressure-Sensitive Tapes, "SCOTCH" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "SCOTCHLITE" Reflective Sheeting, "SAFETY-WALK" Non-slip Surfacing.



1. Mercury two-spindle production face grinder, showing control console at extreme right. Hydraulic hoses provide cushion in each hydraulic line.

Automatic Two Spindle Vertical Wet Face Type Precision Grinder with Transfer Mechanism

Milwaukee: Special to Grinding & Finishing

THIS high-production automatic transfer grinder was recently introduced by Mercury Engineering and is in use for the production of transmission parts by a Detroit automotive manufacturer. Two rotary work-holding fixtures are fitted, one for rough grinding, the other for finish grinding. These, coupled with automatic transfer equipment and automatic size feedback gaging equipment, have enabled the machine to achieve a production rate of 200 pieces per hour, based on .063" total stock removal. Automatic dressing cycles, controlled separately for the two wheels, take place after a predetermined number of pieces have been ground.

Essentially, the machine's operation can be outlined as follows:

1. Load one piece at a time, face up, into transfer mechanism. (Loading can be done manually or by conveyor.)
2. Automatically transfer to first grinding station.
3. Rough grind.
4. Automatically transfer to second grinding station.
5. Finish grind.
6. Automatically transfer to unloading station.
7. Unload.

The automatic gaging device used on the machine has two distinct functions—to check for proper chucking of the workpiece, and to control the ground size of the pieces.

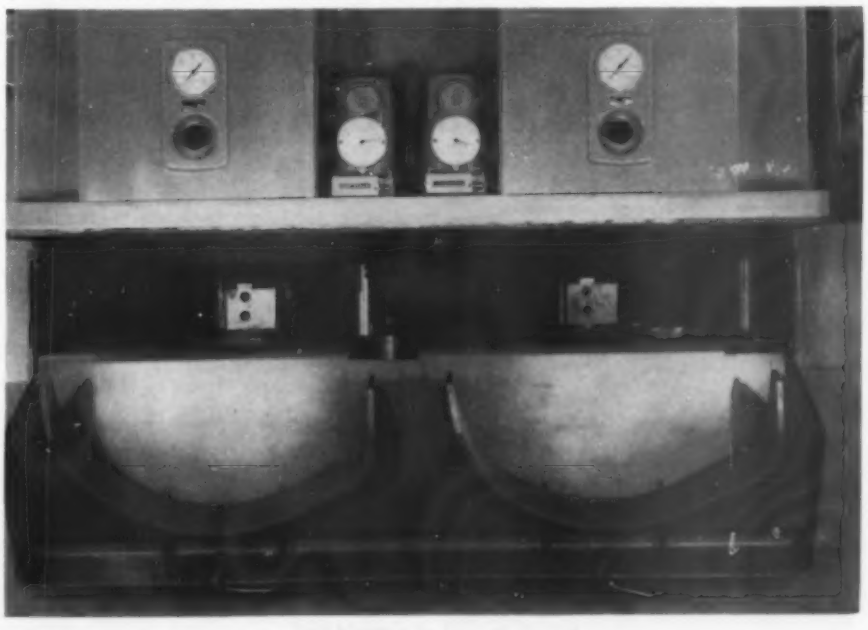
The first function in order of sequence is to check for proper workpiece chucking in the hydraulic chucks. To accomplish this, the gages are dropped down to within ⅛" of the finished level of the pieces, before the heads are lowered. If the gages can drop to within ⅛" of finished level, the heads are automatically lowered and grinding proceeds. But if, as in the case of improper chucking, the gages are prevented from dropping to this level by either piece, the machine will stall with heads up. Pilot lights on the control panel indicate that the heads are in an up position due to improper chucking.

The second function of the gage equipment is size control. After the gage probes inspect the chucking, they continue to drop slowly through a hydraulic cushion to the grinding surface. The carbide faced gage shoes, riding on the pieces throughout the grinding cycle, provide a constant size indication. As wheel wear occurs, and the dials of either or both Sheffield Lectrolair gages indicate the piece is within .001" of high size limit at the end of the spark out dwell, a "memory" circuit is set up. At the start of the next machine cycle, this holding circuit automatically feeds the wheel down to compensate abrasive wear.

The hydraulic system of the machine can be divided into two circuits, the head circuit and the transfer circuit, each of which is served by a 3-HP pump with a maximum pressure of 1100 psi and a maximum delivery of 1120 cubic inches per minute. Total hydraulic system capacity of the machine is 25 gallons.

The head circuit accomplishes retraction of the grinding heads upon completion of the grinding cycle and acts as a controlling cushion for gravity lowering of the heads during grinding. The head pump also supplies

2. Close-up of machine's work stations, showing wheels and Sheffield sizing gages. Diamond dressers visible to right of each station.



power for regulating the height setting of the grinding wheel (which determines piece size).

The function of the transfer pump and transfer circuit is not only to operate the station-to-station movement of the workpiece, but also to actuate the 3-jaw hydraulic chucks of the machine.

Parts ground on the mercury grinders illustrated include the transmission pump body and the front and rear cover plates. The part material is close grained, high tensile, cast iron. Coolant used is water soluble oil emulsion with rust inhibiting additive.

For the above operations the machine uses two 24" O.D., 16" I.D. x 2½" wheels. Specifications of the roughing wheel are 24-H10-B, and for the finishing wheel 30-G10-B. • •

Grinding Wheel For Tough Metal Cleaning

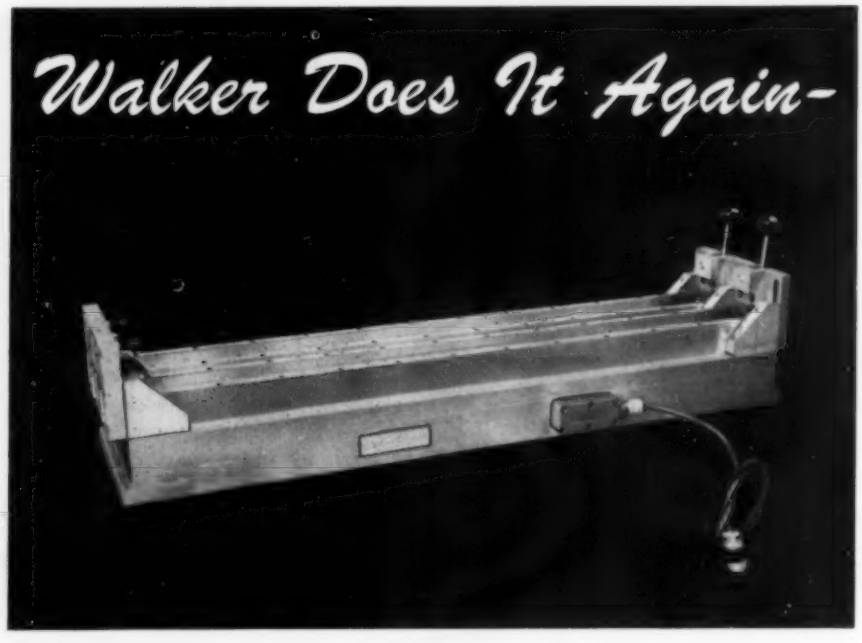
A new heavy-duty grinding wheel has been developed by Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo 2, N.Y., for grinding steel foundry castings.

The wheel is a modified version of one the company designed recently for cleaning stainless steel slabs or billets—one of the toughest metal cleaning chores faced by steel mills.

The modified wheel acts softer but cuts faster than conventional models. It is particularly applicable to large foundries where standardized large-scale production is the practice.

Used in swing frame snagging to remove excess metal, the wheel is being manufactured in sizes ranging from 16 to 24 inches in diameter and from 1½ to 3 inches thick. •

Use HANDY Postpaid Card. Encircle No. 101



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2. Accurate and positive holding assured.

3. Consult Walker Engineers for the solution of your holding problems.

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

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Rubberized Abrasives for Deburring, Smoothing and Polishing

To meet a popular demand in general industry, Cratex Manufacturing Co., 81 Natoma St., San Francisco 5, Calif., has just developed an inexpensive, yet comprehensive polishing kit to handle deburring, smoothing and polishing applications. The kit contains an assortment of 24 of the most popular Cratex polishing wheels, cones, blocks and mandrels which are in wide use in industry — for cleaning and polishing molds, dies and castings . . . removing film, coatings and enamel . . . blending in and polishing welded seams after rough grinding . . . polishing bearing surfaces and raceways . . .

cleaning and polishing commutators and contact points . . . and removing rust, heat marks, tarnish, excess solder, scratches and corrosion.

Each polishing kit contains full instructions on the application of Cratex rubberized abrasives, perfected to give a cushioned action performance in burring, smoothing and polishing on hard or soft metals, plastics, ceramics, glass and other materials. The kit is sold at industrial supply distributors, or may be ordered direct from the company. •

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Available Literature

Catalogs and Bulletins Available from Manufacturers

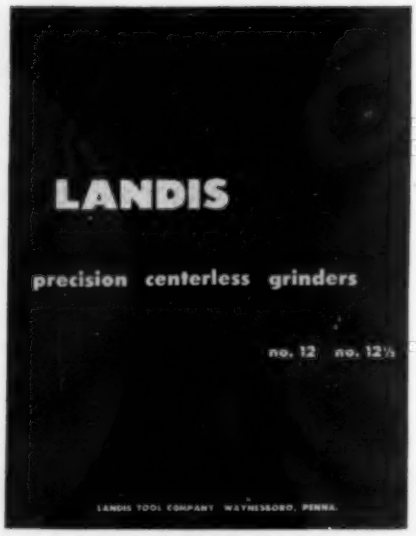
For copies of the literature in which you have an interest use the postage-paid postcard. Merely circle the identifying number and mail the postcard.

1. Surface Grinding. A new booklet called "The Art of Surface Grinding, With the Blanchard Grinder" has been released by The Blanchard Machine Co., Dept. GF, 64 State St., Cambridge 39, Mass. The booklet is designed to assist you in obtaining better quality and quantity performance from your Blanchard grinders. Booklet includes illustrations, specifications, recommended wheels and operation instructions.

2. Steel Stock Lists. A first edition of Allegheny Ludlum Steel Corporation's new series of tool steel stock lists has been made available to the Chicago area. This list gives detailed information as to composition, grades and sizes of steels readily available in the area warehouse. Copies of the booklet can be obtained on request either from the warehouse or from the advertising department, Allegheny Ludlum Steel Corp., Dept. F, 2020 Oliver Bldg., Pittsburgh 22, Pa.

3. Centerless Grinders. A new 26-page catalog covering two sizes, the No. 12 and 12½ centerless grinders has been released by the Landis Tool Co., Dept. G, Waynesboro, Pa. Included are 56 photographs and sketches, specifications and extra equipment. Illustrations include a variety of applications and automation ideas for centerless grinders. Catalog No. is T-55.

4. Precision Balancing. The Driver portable balancing unit is described and illustrated in a folder released by Crestline Products, Inc., Dept. FG, 208 Paramount Bldg., Fort Wayne 2, Ind. It is said that an operator, unassisted, can attach the ball bearing arbor to the machine, move the wheel onto the revolving arbor, lock it, balance it and return it to place on the machine in 15 to 30 minutes with a Driver balancing unit.

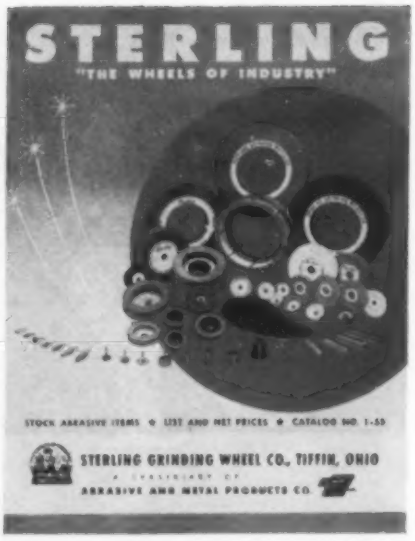


5. Grinding Wheels. Catalog No. 1-55, released by Sterling Grinding Wheel Co., Dept. FG, Tiffin, Ohio, includes stock abrasive items, list and net prices and recommendations of different wheels for special operations. Catalog includes illustrations and specifications of wheels, mounted shapes and points, segments and vitrified and silicate bonded straight and cylinder wheels. General purpose, tool room, internal, cylindrical, crankshaft, centerless, cut-off, surface, snagging and disc grinding are included.

6. Rotary Surface Grinders. Two new circulars are available from Arter Grinding Machine Co., Dept. GR, 15 Sagamore Rd., Worcester 5, Mass., describing and illustrating their model E, 12"-16" sizes, hydraulic rotary surface grinder and the model F rotary surface grinder with a 12" chuck. The model F is a mechanically operated machine as contrasted with the model E which is hydraulic. The model E is a vertical column type machine having a wheel-slide mounted thereon and a sliding table with a rotatable magnetic chuck.

7. Boron Carbide. A handbook on Boron Carbide and Elemental Boron, has just been published by Norton Co., Dept. G, Worcester 6, Mass., providing 16 pages of technical information on materials made by the company for use in the atomic energy field. Included in the book are the following: Boron for neutron absorption, Technical grade boron, properties of boron, commercial grades of boron carbide, radiation damage to boron carbide, bonded boron carbide, boron nitride and metal borides. This illustrated booklet is said to be a useful reference for scientists and technicians in the atomic energy field.

8. Grinding Wheels. A new 56-page catalog has been released by the Chicago Wheel & Mfg. Co., Dept. FG, 1101 W. Monroe St., Chicago, Ill., covering their line of vitrified bond, resinoid bond and mounted wheels. Catalog includes illustrations, specifications, price lists, operating speeds and unit quantity and discount rules.


STERLING
"THE WHEELS OF INDUSTRY"
STOCK ABRASIVE ITEMS ★ LIST AND NET PRICES ★ CATALOG NO. 1-55
STERLING GRINDING WHEEL CO., TIFFIN, OHIO
ABRASIVE AND METAL PRODUCTS CO.

9. Surface Roughness. Micrometrical Mfg. Co., Dept. G, Ann Arbor, Mich., has released a booklet describing and illustrating the practical features and applications of the Profilometer, a direct-reading shop instrument for measuring surface roughness. Measuring surface roughness height in micro-inch units, the Profilometer is said to measure practically any machined or finished surface, internal or external, either straight, tapered or circular.

10. Diamond Turning. The Cleveland Industrial Tool Co., Inc., Dept. F,

HANCHETT new HY-POWER grinder
for
SHEAR BLADES · KNIVES · FLAT SURFACES

HYDRAULIC TABLE DRIVE
MOTORS: 30 h.p. to 75 h.p. CAPACITY: 60" to 296"
GRINDING WHEELS: 30" or 36" diameter segmental
FULL AUTOMATIC CONTROLS • POWERFUL • ACCURATE
HANCHETT MANUFACTURING COMPANY
World's Largest Manufacturer of Knife Grinding and Saw Sharpening Machinery
MAIN OFFICE — Big Rapids, Michigan WEST COAST — Portland 1, Oregon
HANCHETT GRINDERS BIG RAPIDS MICH-CAN

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1080 E. 222nd St., Cleveland 17, Ohio, has released a leaflet describing and illustrating their Citco Turnit diamond tool holder. It is said the diamond can be turned with a flick of the wrist without removing the diamond tool. Diamond turning is encouraged and fewer re-sets are required with Turnit. Holding is rigid, with no vibration and no extension of the tool holder necessary.

11. Tumble Kit. The Fiedler Machine & Engr. Co., Dept. GR, 430 E. 102nd St., New York 29, N.Y. has published an instruction booklet for their Tumble-Kit. The kit provides a quick, easy, inexpensive method of tumble finishing small parts for any plant having a lathe of 11" swing or greater. Kit includes a tumbling barrel, assorted abrasive chips, soaps, finishing compounds, measuring spoon, shaker box and assorted shake out screens and an instruction booklet.

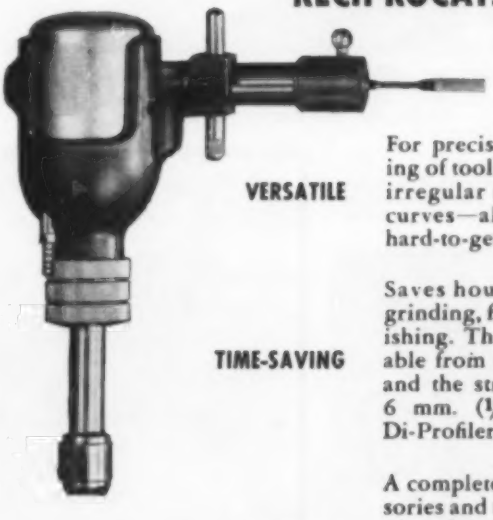
12. Pneumatic Tools and Equipment. M-B Products Div. of Tool Sales Co., Dept. F, 46 Victor Ave., Detroit 3, Mich., has released a catalog describing and illustrating their line of automatic air line filters, air pressure regulating valves, automatic air line lubricators, and pneumatic grinders. Catalog includes prices, specifications and extra parts and accessories lists.

13. Face Mill Grinders. Automatic and hand operated face mill grinders and the No. 2 arc radius grinder are described and illustrated in a new booklet published by Oliver Instrument Co., Dept. RG, Adrian, Mich. The automatic face mill grinder is used for grinding face milling cutters to a predetermined shape. The machine automatically indexes the cutter tooth. The No. 2 arc radius cutter grinder is used where a radius is required on the cutter tooth. It grinds the face, periphery and radius with one pass of the wheel.

14. Surface Grinders. Mattison Machine Works, Dept. FG, 545 Blackhawk Park Ave., Rockford, Ill., has announced publication of a new bulletin containing information about their No. 72 and 100 high-production rotary automatic surface grinders. Designed spe-

any contour,
any detail,
any finish...

THE Di-Profiler
RECIPROCATING HAND MACHINE
does your job faster



VERSATILE
For precision cutting, roughing, finishing of tools, dies, molds. For straight, or irregular surfaces, convex or concave curves—also shoulders, recesses and hard-to-get-at or intricate detail.

TIME-SAVING
Saves hours of tedious hand labor in grinding, filing, scraping, honing or polishing. The reciprocating speed is variable from 0 to 100 strokes per second; and the stroke is adjustable from 0 to 6 mm. (¼ inch). Sturdily built, the Di-Profiler is light; free from vibration.

ADAPTABLE
A complete assortment of efficient accessories and tools is available for every type of work: steel and diamond files, diamond discs, laps, hones, T-C scrapers; also rotary tools including diamond wheels, burrs and points.

Investigate the Di-Profiler —a minor investment that assures savings of time and costs. Ask for a demonstration or price list DG-115.

ENGIS EQUIPMENT COMPANY
Sole authorized distributor for the U.S.
431 S. DEARBORN ST., CHICAGO 5, ILL.

Encircle No. 224 on postpaid card

cifically for machining flat surfaces on long run jobs in continuous, single pass operation, these grinders are said to offer all the features of high horsepower and rugged construction. According to bulletin No. 147-2, machines of special work heights can be produced if the job warrants.

15. Industrial Lubricants. A new illustrated bulletin describing W & B industrial lubricants has been released by the White & Bagley Co., Dept. G, Worcester, Mass. W & B lubricants are said to increase production and decrease costs; produce smoother finishes and closer tolerances; keep machines, tools and work clean; and give an excellent after-protection against rust. Grinding concentrates and lubricants, pastes, special bases, honing oils and forging lubricants are included along with a blending guide.

16. Diamond Compound. The Parsons Diamond Products, Inc., Dept. F, 595 New Park Ave., West Hartford 10, Conn., manufacturers of industrial diamond tools and diamond abrasives has available a bulletin describing and illustrating Microlap Diamond Compound for lapping, polishing and super finishing. Microlap is said to be the ideal finishing compound for tungsten carbide and tool steels. It is a ready to use diamond paste composed of uniformly graded diamond powder suspended in an oil solution base.

17. Micro-Form Grinders. Two new bulletins are available from the Sheffield Corp., Dept. RG, Dayton 1, Ohio, describing and illustrating their model No. 121, 121-C and 122 Micro-Form grinders. Grinders are available with the scope only, model No. 121, or with the combination scope and viewing screen model 122. Either the viewing screen or the scope can be used at will on the model 122 by flicking a switch. Both the screen and the scope are 30 power and are accurate to within .0003".

18. Grinding Wheels. The Simex Red wheels, that are lightweight and extra strong for rough, tough grinding are described and illustrated in a new folder released by Simonds Abrasive Co., Dept. FG, Philadelphia 37, Pa. The reinforced Red wheels are a lightweight, rigid type bonded grinding wheel for heavy-duty work where stock removal is given preference over finish. They are designed for use on portable disc sanders and right angle portable grinders.

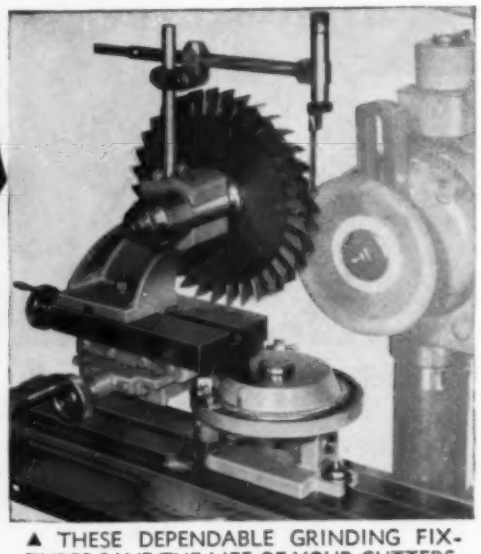
19. Tumbling Barrels. A new two-color bulletin is offered by Tumb-L-Matic, Inc., Dept. F, 4510 Bullard Ave., New York 70, N.Y., describing and illustrating Type XL wet process tumbling barrels for fast economical finishing operations. These barrels employ a compound containing abrasive materials to cut down, deburr, smooth and burnish a great variety of metal and plastic parts. Information is presented on barrel sizes, drives, controls, liners and optional equipment.

20. Liquid Honing. The Vapor Blast method of liquid honing is described and illustrated in a new bulletin released by the Vapor Blast Mfg. Co., Dept. RG, 3025 W. Atkinson Ave., Milwaukee 16, Wis. This method of surface finishing uses fine abrasive powders (40 mesh to 5000 mesh sizes) suspended in a chemical solution and forced at high velocity through special nozzles against the surfaces to be treated.

THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)

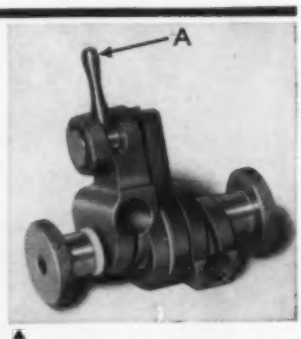


▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 602

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR:
SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

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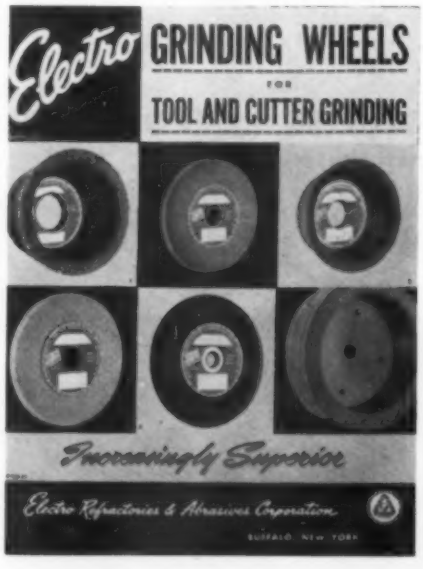
21. Wheel Dresser. The Tang-A-Sine combination radius and angle wheel dresser is described in a bulletin available from Vamco Machine & Tool, Inc., Dept. G, Pittsburgh 15, Pa. The tool is said to eliminate the use of a comparator when a center distance between two radii tangent to a common angle is desired. All settings can be made with gage blocks to insure utmost accuracy.

22. Blast Cleaning. Bulletin No. 100-D describing one of its table-type airless blast cleaning machines has just been published by Wheelabrator Corp., 1169 S. Byrkit St., Mishawaka, Ind. The machine is intended for cleaning work which does not have too many pockets or vertical edges. Other applications include cleaning work in connection with reconditioning, like gas and water meters and automotive parts. The machine is claimed to be good for flat or fragile work which requires careful handling.

23. Grinding Wheels. Bulletin T-855 published by Electro Refractories & Abrasives Corp., Dept. F, 344 Delaware Ave., Buffalo 2, N.Y., outlines in a concise manner a wide range of abrasives, bonds and structures to meet every tool room requirement in the grinding of high speed and special alloy steels and cemented carbides. Bulletin includes illustrations, specifications and techniques for best results.



24. Diamond Particles. Cemented diamond particles is said to introduce a totally new concept in diamond tool engineering and design. This advanced material with a million points is composed of uniformly distributed diamond particles securely held in position by means of a newly developed Koebelite powdered metal matrix. These CDP wheel dressing tools employing smaller diamond particles are said to fracture the small abrasive grains of the grinding wheel in such a way as to produce a faster and cleaner cutting wheel. Literature is available from Koebel Diamond Tool Co., Dept. RG, 9456 Grinnell, Detroit 13, Mich.

25. Belt Grinding. Bulletin No. 104, issued by the Grinding and Polishing Machinery Corp., Dept. R, 2530 Winthrop Ave., Indianapolis 5, Ind., describes and illustrates the G & P 6-72 belt unit. The unit can be used for almost every type of belt grinding and polishing within the capacity of its 2½" belt and 2 hp motor. The G & P 6-72 is a unit rather than a machine, because it is used as a component for making machines. It may be a primary part of such a machine or an auxiliary part, along with other cutting tools.

26. Cutter Grinder. The Panto Model CG for single-lip engraving and routing cutters is described in a flyer issued by H. P. Preis Engraving Machine Co., Dept. GF, 651 Route 29, Hillside, N. J. Spindle is also equipped with index unit for grinding 2-, 3- or 4-lip cutters to any angle and clearance desired.

27. Surface Form Grinder. Bulletin 50226 released by Ex-Cell-O Corp., Dept. F, 1200 Oakman Blvd., Detroit 32, Mich., describes and illustrates the style 84 precision surface form grinder for grinding flat, grooved or curved surfaces in an automatic cycle. The machine base is heavy and rigid to insure accurate work and good finish. A reciprocating work table is hydraulically operated and electrically controlled.

SANFORD BENCH SURFACE GRINDER
MODEL SG

for Wet or Dry Grinding!*

PRECISION • SPEED • SENSITIVITY

A *low cost*, precision machine for surface grinding dies, instrument parts, gauges and other small parts which would fit in the palm of the hand.

By using Sanford Bench Grinders many manufacturers of precision machinery have drastically cut over-all costs for finishing small intricate parts. This releases large, more expensive machines for heavier duty work.

The Sanford SG is the *only* low cost Bench Surface Grinder that

- **Grinds to less than .0001" tolerances**
- **Operates without vibration**
- **Assures long life because Meehanite castings are used in its construction**

SPECIFICATIONS—4" traverse —8" longitudinal—6" vertical under 4" wheel. Approximate weight 160 lbs.

Complete details are included in illustrated bulletin. Send for your copy today.

Reconditioning facilities, replacement parts and special attachments are available. Send for price list.

**With optional equipment*

SANFORD MANUFACTURING CORP.
1026G Commerce Ave., Union, N. J.

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CORTEX WHEELS

Father-to-Son Skill

They call it the "Jacob's Ladder Route" and you'll see why as you drive east from Pittsfield. It follows Walker Brook, twisting and turning down through the hills — and quite suddenly you're "down the mountain" and in a town.

It's Chester, Massachusetts, where the making of grinding wheels has been a family occupation since back in the 80's.

Maybe this father-to-son knowledge of how to make good grinding wheels is the biggest reason why Cortland Wheels give so much satisfaction. These fine people take pride in their work — take pride also in the modern equipment they use.

It's a good combination: experience, skill and modern methods, especially when it's backed by an organization alert to the ever challenging needs of the grinding and finishing industry.

It's a combination that pays off for our customers. Will you be one? We'd like to have you.

CORTLAND

Reinforced, Resilient . . .
and how they Bite!

CORTEX WHEELS have the smoothing and finishing action of coated abrasive discs and the free-cutting and lasting qualities of grinding wheels. The abrasive grains are firmly imbedded in fibre and bonded with our specially developed Cortex resin. This construction results in a *reinforced* disc which is light in weight, yet will withstand more side strain than the standard type of thin resin-bonded cut-off wheels.

CORTEX WHEELS are especially suitable for grinding light gage metal fabrication and for work where finish is of some consequence. The *flexibility* of the wheel enables you to grind rounded surfaces and hard-to-reach places. The *light weight* of these wheels tends to lessen operator fatigue when used with portable type grinders. Also — there's less strain on machine spindle.

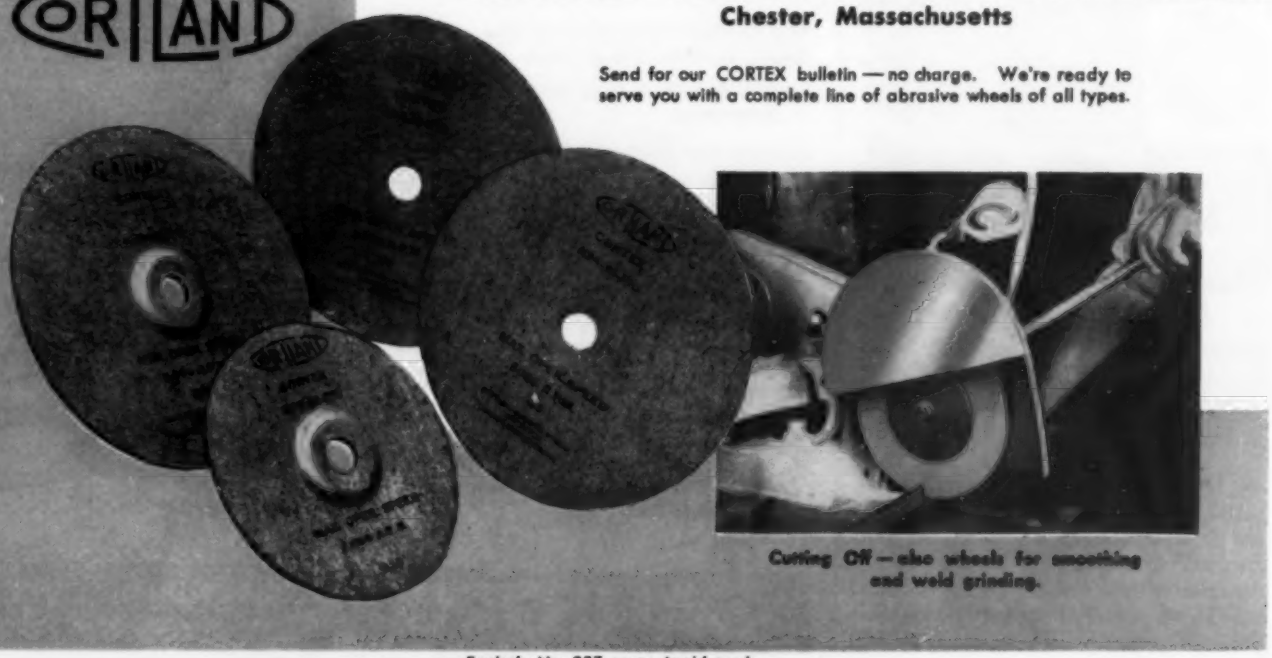
CORTEX WHEELS are available in two types:

Straight Wheels may be used on cut-off machines, portable electric saws, saw tables, bench and pedestal grinders and portable grinders. They are recommended for cutting off non-ferrous and non-metallic materials, light stock removal, slotting, grooving, sharpening, edging.

Depressed Center Wheels are particularly adapted for use on portable disc sanders and right-angle type portable grinders.

CORTLAND GRINDING WHEELS CORPORATION
Chester, Massachusetts

Send for our CORTEX bulletin — no charge. We're ready to serve you with a complete line of abrasive wheels of all types.



Cutting Off — also wheels for smoothing and weld grinding.

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Fully Automatic Gear Grinding Machines

The Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich., has announced the availability of a complete new line of fully automatic gear grinding machines, believed to be the first ever to be offered to industry.

The following improved automatic features are available on the complete line of machines: automatic loading; automatic rejection; automatic stock equalizer; automatic release of work pieces; automatic down feed; automatic trimming.

In addition to these features the following are offered: the controlled flow of coolant through the grinding wheel insuring non-tempered, case-hardened gears; single or double diamond trimmers which offer perfect blending of fillet and profile; multi-ribbed grinding wheels which increase the production rate by increasing the number of teeth being ground simultaneously; multiple fixed diamond trimmers which virtually eliminate grinding wheel dressing time; and a time recorder attachment which accumulates the total machine cycle time for production control. •

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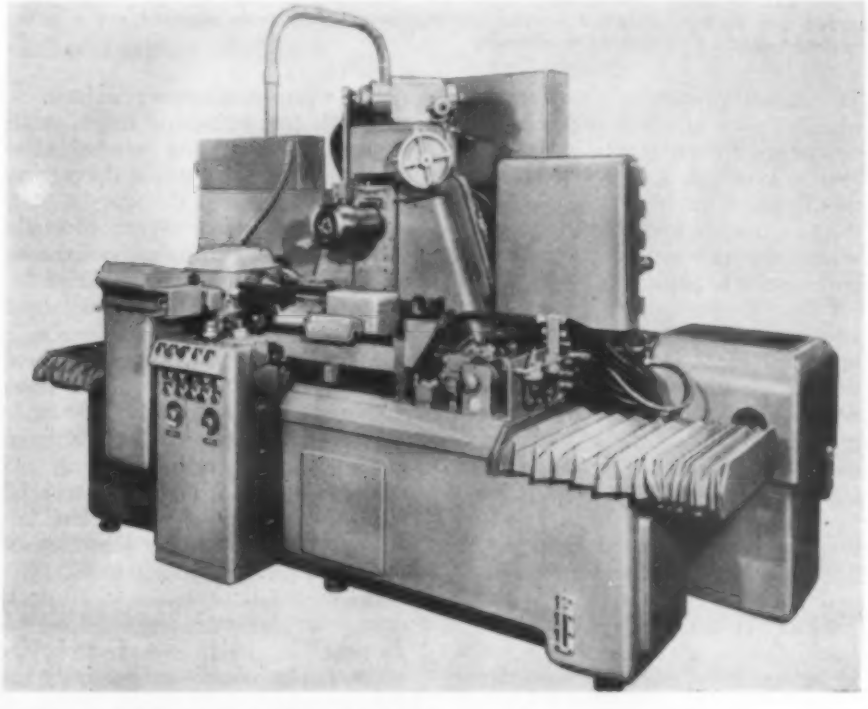


New Coated Abrasive Wheel for Polishing

A new device for polishing metal, which in one plant allegedly cut polishing costs by one-fifth, and in another outlasted set-up wheels 60-to-1, has been developed by Minnesota Mining and Mfg. Co., Dept. A5-266, 900 Fauquier Ave., St. Paul, Minn.

It makes possible a new method for polishing all types of metal for plating, painting, or architectural finishing, without the use of fine grit set-up wheels, rag or sisal buffs, or brushes.

The device is called the PG polishing and grinding wheel. It consists of hundreds of pieces of cloth coated abrasives factory-formed into a wheel that can be used on rotary or straight line automatics, or on standard lathes for hand operations.

The wheel differs in that it removes stock as part of its polishing action. previous method.

One of the major features of the wheel is that its rate of cut and the micro inch finish it produces remains constant from the beginning of a new wheel until it is worn down to the hub. It is not necessary to increase arbor speed to maintain cut during the life of the wheel.

Some other advantages of the wheel include: greatly reduced down-time on automatic equipment, since some wheels have run continuously for as long as six shifts; the space and time for operating a set-up wheel department is eliminated; the PG wheel is cleaner than a buffing operation since it uses oil instead of a compound; and the wheel remains sharp throughout its life because fresh mineral grain is exposed as the wheel wears.

1. These are the components for the PG wheel assembly: at right is the wheel; at upper left the hub; and at left center the two flanges. Also in the picture are screws and bushing supplied by the manufacturer. Only tools required are a soft hammer, guide pins and Allen wrench.

This abrading-polishing action and the wheel's ability to conform enable it to remove mild draw marks in the same process in which it generates a buff-type finish.

At a metal manufacturing plant where the product is polished and buffed prior to plating, PG wheels in a 220-240-320 grit sequence are producing an average of 11,000 pieces before needing replacement. On a straight line automatic machine, 13 heads with PG wheels are now in operation, and have replaced 20 heads using a combination of 12 set-up wheels and eight sisal buffs. Unit finishing cost has been reduced one-fifth, from 6c to 5c. Production has been increased from 1,800-2,500 pieces per day to between 4,000 and 4,500 pieces per day. The finish produced by the wheels is equal to 4½ micro inches, as compared to a finish of between 5½-6 micro inches with the

The wheel is adaptable to hand or automatic operations, and will take the shape of the part being polished. The shape will remain constant during the life of the wheel.

Lubrication, of the type presently used with some buffing and intermediate finishing operations, also helps develop better wheel finishes and longer wheel life.

At another plant using the new wheels, a grit 220 wheel on one lathe shaft and a grit 240 wheel on the other shaft are finishing more than 500 large pieces before wearing down; the amount of work it previously took 60 set-up wheels to do. Downtime has been practically eliminated because of the wheel's long life.

PG wheels are available in 20 stock sizes, with diameters ranging from 14 in. to 17 in., in 2, 3, 4, 5, and 6-in. widths. The wheels are currently be-

2. PG wheel ready for use on a lathe spindle.

ing made with two types of mineral coatings, aluminum oxide and silicon carbide, in the full range of polishing grits.

The wheels are mounted on a hub assembly which can be adapted to fit any spindle. Both wheels and hub assemblies are being sold nationally through industrial distributors and 3M

3. For hand operations, the PG wheel is readily formed and retains shape throughout wheel life. Because the wheel holds the shape of the piece being finished, only light operator pressure is required.

branch warehouses. Further information is available from Minnesota Mining and Manufacturing Co., Dept. A5-266, 900 Fauquier Street, St. Paul 6, Minn. •

Use HANDY Postpaid Card. Encircle No. 104

Light Weight Girders for Kiln Cars

Smaller, lighter girders that still give maximum supporting strength for the kiln load in ceramic firing have been developed by Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo 2, N.Y. The girders are made of 85 per cent silicon carbide and replace those of heavier and bulkier fire clay or semi-silicon carbide construction.

The girders are placed between the top and superstructure of kiln cars and are designed for maximum strength and heat distribution while distributing weight evenly over the car top.

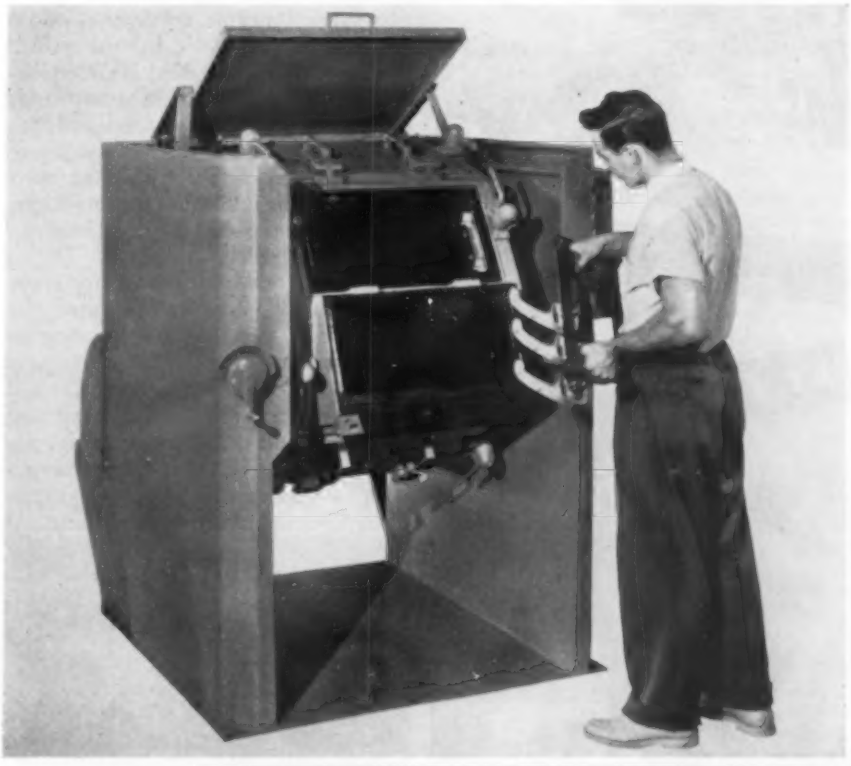
They come in lengths up to 4 feet, in heights from 4 to 9 inches. Webb thickness is 1½ inches. Bearing surfaces at top and bottom are 4½ inches. •

Use HANDY Postpaid Card. Encircle No. 105

Stationary Fixture Finishing Machine

A new eight-door stationary fixture finishing machine designed primarily for coloring of aluminum castings has been announced by Roto-Finish Co. of Kalamazoo, Mich.

The new machine has a door on each flat of a single compartment cylinder. Fixture pads are attached to the octagon side walls of the compartment just inside the door opening.



Fixtures are in the form of grids, which fit attached pads. After fixture is placed inside the cylinder, it is held in position during the processing operation by the pads and by pressure of the closed door pushing it firmly into the contoured pad. Fixtured parts are held by the fixture grids to effectively expose them to processing media.

It is claimed to be not necessary to remove processing media or solution when removing work load from the compartment.

Processing compartments vary in size up to 48 inches long and 42 inches in diameter. Most suitable size, according to Roto-Finish, for average processing is a compartment 32 inches long and 42 inches in diameter.

The latter size, used for coloring aluminum castings with steel balls, uses a 7½ h.p. drive equipped with automatic reversing electric controls.

Doors are hinged for rapid servicing of fixtured parts resulting in economical operation.

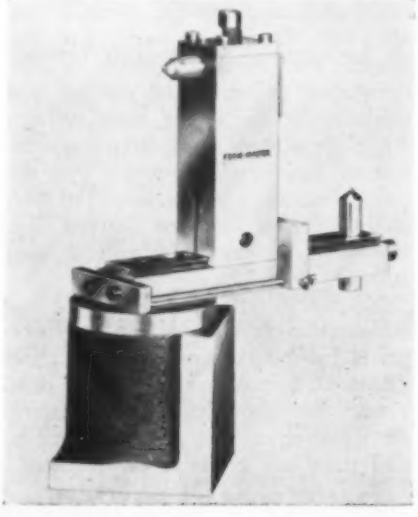
The machine is said to give a low cost bright lustrous finish to aluminum tool housings, food choppers and many other castings. •

Use HANDY Postpaid Card. Encircle No. 107

New Heavy Duty Dresser for Larger Radii

A new model J & S Form Master wheel dresser has been announced by the J & S Tool Co., Inc., 87 Dorsa Ave., Livingston, N. J., manufacturers of the Fluidmotion line of grinding wheel dressers and other precision tools. This new dresser, designed to meet the needs for low cost unit for close precision work can take up to an 8″ convex radii on an 8″ wheel and up to a 12″ concave radii on an 8″ wheel.

As found on other Form Master models, this new one dresses with the diamond point horizontal to the center of the grinder spindle. Sealed ball bearings insure smooth operation and lasting durability. Excepting for the base, parts are hardened and ground. Drilling and tapping of holes are possible in the cast iron base when needed for quick set up on cylindrical grinders. ■



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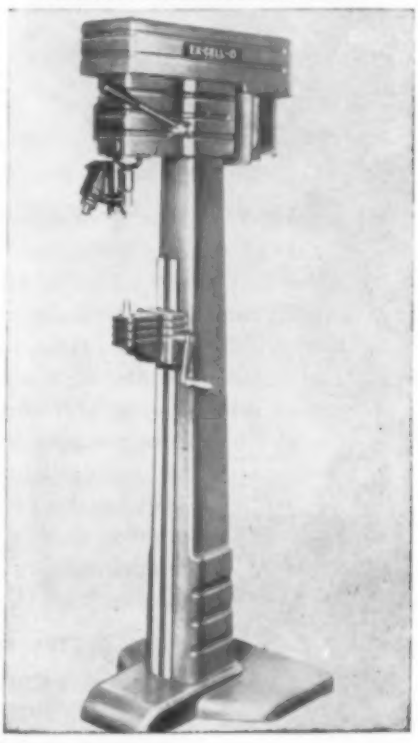
Center Lapping Machines

Center lapping of workpiece centers eliminates the distortion caused by heat treat, scale or scored centers. On any precision operation between centers, close tolerances are almost impossible to maintain if the workpiece centers are not true and clean.

The Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich., with precision their most important product, manufactures center lapping machines and has made center lapping a habit in the plant. In any plant where accuracy between centers is important, lapped centers most often mean the difference between scrapped and acceptable parts. An inexpensive process, the operation requires only a few seconds.

Ex-Cell-O center lapping machines are built for many years of dependable service. Rigidly constructed, the motor and precision spindle are supported by a sturdy base and stout column. The work rest is adjustable for various lengths of workpieces. A lapping stone dresser is provided with the machine or an adjustable angle dresser is available as extra standard equipment. The dresser swings out of the way when not in use. •

Use HANDY Postpaid Card. Encircle No. 109



Lusol K-7 means

MORE GRINDING

BETTER GRINDING

AT LOWER COST

A TRANSPARENT ALL-CHEMICAL SOLUTION FOR GRINDING

Lusol K-7 is a new all-chemical liquid concentrate designed for a wide variety of grinding operations. It is recommended for use on all steels and is particularly suited for cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. Instantaneously soluable in any water, hard or soft, it forms a clear, transparent, colorless solution that resists contamination, settles chips super-fast, and remains clear after repeated use. It is non-foaming and runs absolutely flat under all conditions. It provides maximum rust protection for all ferrous metals, including cast and malleable irons. It maintains clean wheels at all times. They just don't load up when you use Lusol K-7. For better grinding every time, use Lusol K-7. Write for complete information.

THE Lusol LINE

. . . BETTER PRODUCTS FOR BETTER METAL WORKING

F. E. ANDERSON OIL CO., INC.

PORTLAND, CONNECTICUT

5A055

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Compounds and Media for Barrel Finishing

A complete line of abrasive, burnishing, cleaning, and neutralizing compounds prepared especially for precision barrel finishing operations is now available from Newton Industries Inc., 100 Saw Mill Road, West Haven, Connecticut. Four classes of compounds have been formulated specifically to meet varying requirements along progressive stages of barrel finishing operations. According to the manufacturer, they will not paste, plug, or bind up tapped or blind holes.

Newton class A compounds for heavy deburring and cutting are used for initial stages of finishing, depending on the character of the metal, shape, size, and degree of finish required. Class B compounds for regular deburring and semi-burnishing can be used for follow-up finishing. Still other parts may require a third operation with Newton Class C compounds for burnishing. As a last stage, Class D compounds for

cleaning possess wetting agents and disbursers which have a high detergency value and buffing action and contribute to finer metal color and finish.

Designed for use with all media types, Newton compounds are particularly effective with Newton Polishapes and Burnishapes media, specially cast zinc alloy forms of specific size and shape. The elongated shape of the Polishapes performs the cutting and polishing on the larger work surfaces while the pointed ends carry the abrasive or polishing compounds into the holes, recesses, and crevices. The perfectly spherical shape of Newton Burnishapes are ideal for burnishing operations.

Newton Industries Inc., offers free consultation service on all precision barrel finishing operations. Prices and illustrated literature describing the compounds and guide tables for finishing all types of metals, plastics, castings, and parts are available on request.

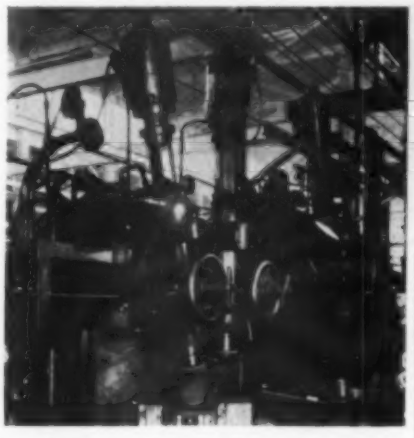
Use HANDY Postpaid Card. Encircle No. 106

Ram-Conversion Spindle

Among the many versatile variations of Super Precision spindles produced by The Standard Electrical Tool Co., 2488-96 River Rd., Cincinnati 4, O., is the ram-conversion spindle for boring mills.

The illustration is of a boring mill completely converted into a vertical chucking grinder, the left hand ram grinding an internal taper at the same time the right hand ram is completing an OD grinding operation.

The illustration shows a directly coupled precision motorized unit, with the grinding spindle integral with the ram. Standard also offers a belted motor drive with variation in grinding spindle speeds. For those who prefer to convert the ram for occasional grinding and metal cutting, a design is available which permits interchange of cutting tool holder with various sizes and lengths of grinding quills.



There is the option of a straight grinding wheel arbor, or taper nose with balancing type of wheel holders, both for internal and external grinding. A ram-conversion unit is also available for all makes and sizes of boring mills, also grinder attachment assemblies for independent mounting on ram or turret of the boring mill. •

Use HANDY Postpaid Card. Encircle No. 110

Barrel Deburring Compound

Oakite FM 184, a mildly acidic compound for barrel deburring, descaling, and derusting, has recently been introduced by Oakite Products, Inc., 157 Rector St., New York 6, N.Y., manufacturers of metal cleaning and finishing materials.

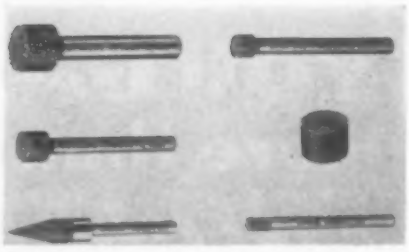
The new material was specifically designed to replace raw acids in barrel operations, where alkaline materials and abrasives are impractical because of time limitations. It is also designed to improve color of steel after alkaline deburring; to remove heat scale from steel; and to brighten brass, either with or without the use of abrasive media. It is said to have good foaming properties at the recommended concentrations of 1 to 3 ounces to the gallon of water. It may be added dry to the burnishing barrel. •

Use HANDY Postpaid Card. Encircle No. 111

Diamond Impregnated Wheels

Vinoy diamond impregnated wheels contain crushed diamonds imbedded in a special carbide matrix. Designed primarily for the carbide die industry for grinding carbide dies, bushings, etc., they may also be effectively used on other hardened materials such as nitrided or case hardened steels.

Wheels are furnished standard in an 80 diamond mesh, but are also available in ranges from 60 to 200 mesh. When worn down, the diamonds are re-exposed in a bench lathe using No. 220 grit silicon carbide abrasive with a flat cast iron lap. This procedure abrades the matrix and causes the diamond particles to again protrude. Diamond Products, Inc., 327 Prospect Ave., Elyria, O. •



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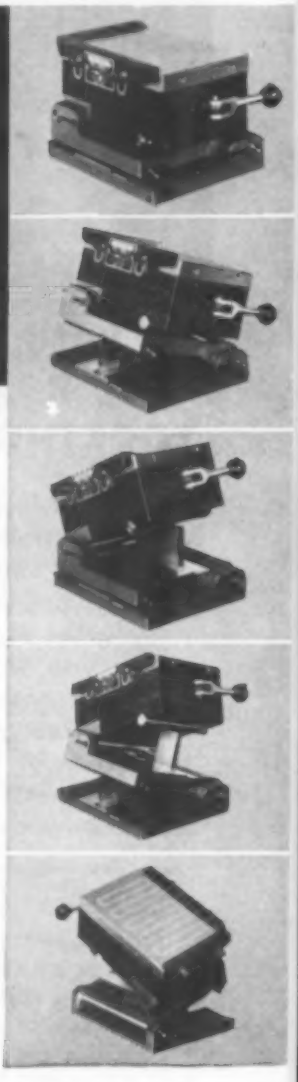
Industry's most versatile Magnetic Chuck

MAGNA-SINE



Here is a magnetic chuck that not only handles your parallel work but angular work, too. And angular set-ups to gauge block accuracy take but a matter of minutes!

Any angle—single or compound—is set up by inserting gauge blocks between the Magna-Sine's precision hinged base plates. Correct blocks to use are indicated in Table of Constants provided. Hours of set-up time are saved, angular accuracy is positive, work is held distortion-free on permanent magnet chuck.

Thousands in use for grinding, inspection, drilling, boring.
Write for free catalog which shows all styles and sizes . . . price list included.

OMER E. Robbins COMPANY
Dept. H-2, 24800 PLYMOUTH RD. • DETROIT 39, MICHIGAN
Also producers of special gauges and fixtures

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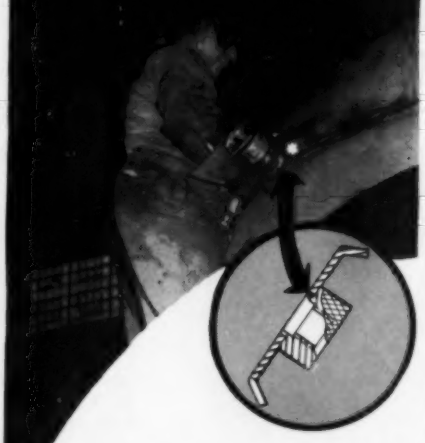
YOU Get more than TRIPLE strength



with this NEW
CARROLL
LOCKING DEVICE

Cup wheel insert assemblies with the Carroll Locking Device give three times the holding strength previously obtained . . . *plus* the degree of concentricity you want! They are designed and produced for trouble-free grinding wheel production by CARROLL, specialists in metal components for the abrasive products industry.

*Safety guard removed for illustration.

SPECIAL CARROLL SERVICE

Let CARROLL engineer your metal components. We offer planning, design, and prototype service on special components or special applications of the Carroll Locking Device.

Ask for a Carroll Catalog, or send your blueprints for a prompt, practical quotation.

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138 DEWEY ST., WORCESTER, MASS.
OVER 50 YEARS OF PRECISION METAL FABRICATION
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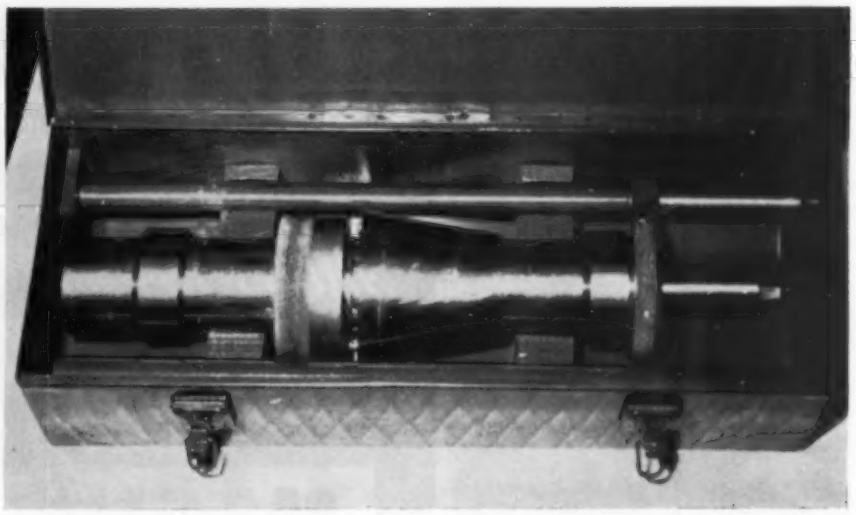
Portable Balancing Unit for Precision Balancing of Wheels, Chucks, Pulleys

The new Driver balancing equipment manufactured by Crestline Products Inc., 208 Paramount Bldg., Ft. Wayne 2, Ind., was designed originally for balancing cylindrical and centerless grinding wheels but fine results are also obtained in the balancing of chucks, pulleys and other heavy products that require balancing.

This compact, portable unit is portable, low in cost, built to last, and made for almost every type of grinder.



1. Complete portable unit for No. 2 Cincinnati centerless weighs only 42 pounds.

Driver balancing equipment facilitates smooth running perfection that only a precision balanced wheel can give. Only such exact balancing can maintain very close tolerance grinding and eliminate those extra finishing operations.

This device is claimed to be efficient and reliable in operation and eliminates the necessity of completely removing the wheel by hoists or other heavy equipment. This also eliminates hazards to workmen and danger or damage to the machine.

It is said that an operator, unassisted, can attach the ball bearing arbor to the machine, move the wheel onto the arbor, lock it, balance it and return it to place on the machine in 15 to 30 minutes with a Driver balancing unit. For heavier wheels, where required, a support is added to end of arbor.

The Driver combination adjustment weight eliminates all tedious time consuming effort that was necessary to adjust and then tighten weights at a balancing position. Set the master weight at the approximate position and then the internal weights can be quickly adjusted for that perfect balance.

Also available is a bench model for various types of balancing units. These are used where balancing must be done away from the machine, as for a production line. The Driver balancing units are made under patent No. 2595777 which allowed 13 claims of originality. A number of these claims being basic. •

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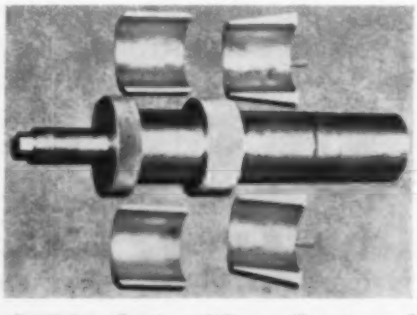
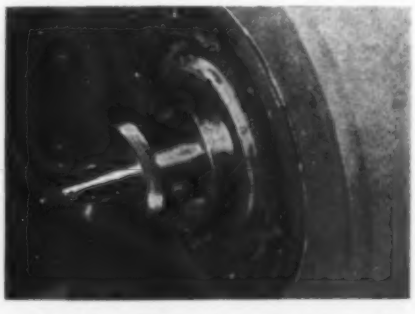


2. Arbor showing sliding collar, tapered sleeves, location spacer sleeves and safety lock nut.



3. Ball bearing arbor attaches to the spindle and becomes an extension of spindle.

Automatic Grinding Wheel Dresser

Automatic dressing of grinding wheels is superior to manual dressing as it insures removing a uniform amount from the periphery of the wheel at a uniform feed rate during each dressing cycle. This not only aids in attaining a better quality of wheel and, consequently, part finish but extends the life of the wheel.

The Citco automatic grinding wheel dresser is an electrically-controlled hydraulic servo unit developed for use on No. 2, 3, and 4 Cincinnati centerless grinders and for all large external grinders. The unit for the Cincinnati centerless grinders is an attachment which replaces part of the standard dresser. The wheel is dressed in two passes of the diamond. The amount to be removed by each pass and the respective cross-feed rate can be accurately preset in two identical sets of controls. After these adjustments have been made, the operator needs only to push a button and the dresser will be automatically cycled taking a uniform amount off the periphery of the wheel each cycle. The wheel must be moved into the work by the operator to compensate for the dressing as is the case with the standard dresser.

Other features of the Citco dresser are: (1) the diamond is rotated to produce uniform diamond wear; (2) the quill travel is 5½" and thus does not require resetting to use up the entire wheel; and (3) the dressing coolant is automatically turned on and off in the cycle.

Advantages claimed of the Citco dresser are: (1) 50 - 80% reduction of dressing time; (2) greater wheel life through uniform dressing; (3) greater diamond life through uniform wear, and (4) greater uniformity in quality of finished parts.

The Citco dresser for external grinders is an integral unit having its own ways and is mounted above the wheel. It dresses the wheel through a hole cut in the cover guard. Dressing can be accomplished with the work piece in place. The Cleveland Industrial Tool Co., Inc., 1080 E. 222nd St., Cleveland 17, O. •

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NEW!

DUMORE TOOL POST GRINDER turns standard machine tools into heavy-duty grinders

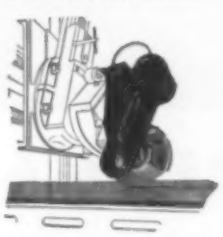
YOUR PRESENT EQUIPMENT PLUS A DUMORE "25" WILL CUT YOUR GRINDING COSTS ON THE BIG JOBS

Large external grinding jobs, which have been impractical or impossible for you to do in your own plant, can now be easily and economically handled on your existing machine tools. The answer is the new Dumore Series 25 Tool Post Grinder mounted on lathes, vertical boring mills, planers, shapers and other standard machine tools.

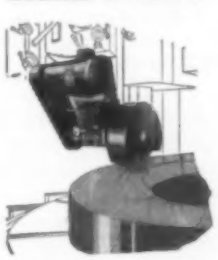
Size of the work is limited only by the machine tool itself. Mounted on a 20" or larger lathe, this powerful grinder will grind and finish all types of cylinder work such as textile and rubber printing press rollers. Motor and quill can even be turned end-for-end for back of lathe mounting. On a planer, the largest surface grinding jobs are done easily. And on a vertical boring mill, it saves hours of set-up and transfer time on normally difficult work.

The Dumore "25" is powered by a 3 H.P. induction motor that assures controlled wheel speed under the severest load conditions. Equipped with built-in magnetic starter, overload protector and greased sealed bearings. Rugged, cast iron frame built to withstand vibration. 12 inch wheel capacity.

MOUNTED ON LATHE



MOUNTED ON PLANE



MOUNTED ON VERTICAL BORING MILL

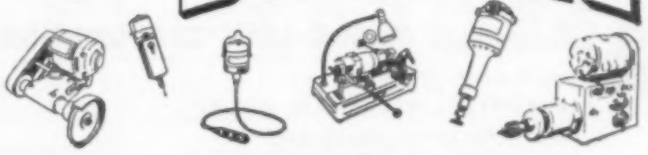
THE FAMOUS DUMORE QUILL ... HEART OF THE GRINDER

Recognized throughout the industry for its precision. Equipped with Timken precision tapered roller bearings, grease-lubricated and pre-loaded at the factory having a radial capacity of 955 lbs. and a thrust capacity of 655 lbs. Swings wheel 12" x 1½" at 1750 rpm.

WRITE FOR BULLETIN 425
For Detailed Information On The New Dumore Series 25 Tool Post Grinder

DUMORE®

AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS



1326 Seventeenth St., Racine, Wisconsin

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Grinder Features Easy Servicing

Hammond Machinery Builders have improved their line of No-Dust grinders. Servicing the built-in dust collector unit is now accomplished from the front of the machine. The grinder may now be placed next to a wall and requires practically the same floor space as a grinder without the self-contained dust collector unit.

Grinders are available in three sizes of 1, 2 and 3 hp motors using 10", 12" and 14" diameter grinding wheels. The self-contained built-in dust collector unit traps dust and dirt at its source from light tool or snagging operations or from intermittent grinding on heavier operations.

Although the No-Dust Grinders are actually 2-in-1 machines, practically the same floor space is used as for a single purpose grinder only.

The same basic construction is available without the built-in dust collector designated the OK grinders. A particular advantage of the OK grinders is that the dust collector unit can be added at any later date and requires only a few minutes for installation. •

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Filter-Lubricator for Wider Use

With the advent of automation and the increased use of air cylinders or other cycling pneumatic equipment Nu-Jett Products Corp., 1355 Michigan, N.E., Grand Rapids, Mich., has enlarged its line to include a larger type filter-lubricator designed for use with ¼" and ⅜" pipe.

Basic feature of this new unit, aside from wider use range, is that oil is always present in the air stream and accordingly there is instant response to sudden demand changes. The moment air flows through this unit oil moves with it. The unit has no oil tubes, needle valves or syphons to give rise to lag of oil movement. This instantaneous oil flow is readily adjusted by turning the control on top of the lubricator. This control raises and lowers a porous metal oil feed wick as well as varies the size of the venturri which governs the air velocity around the wick. Both air and oil are filtered and both filters are permanent and reusable. The filter unit of the filter-lubricator has a built in automatic cleanout which drains all collected moisture when the air line pressure is off.

The Nu-Jett Corporation reports an efficient and tested performance of this compact unit over a wide range of pressures and volume with very low pressure drop. Complete information regarding the production, distribution and OEM policy is available from the manufacturer. •

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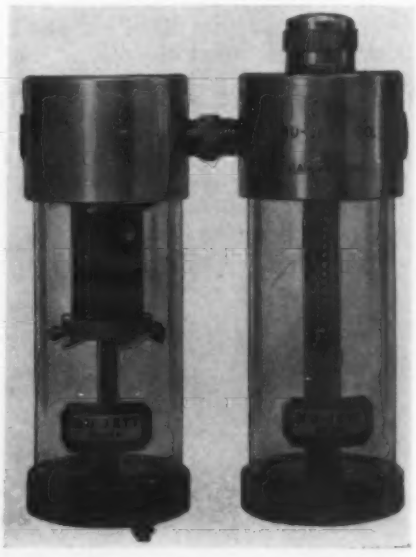
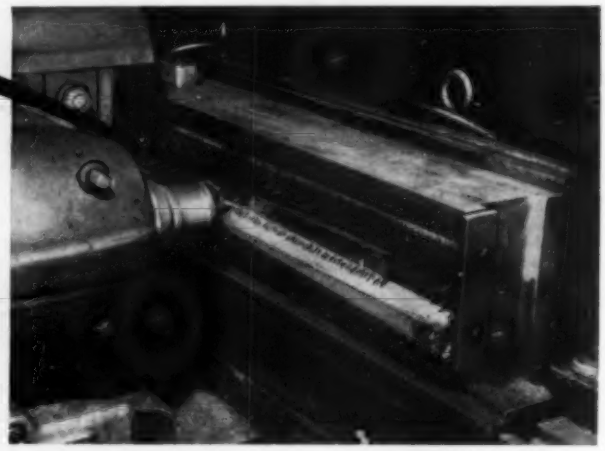


Hanchett Magna-Lock Magnetic Chuck at Turchan Follower Machine Co.



REDUCES SETUP TIME 66.6%

THE JOB: Milling hard cast iron gibs, 1⅜" maximum width, variable lengths, 60° compound angle, .250" taper per foot. Roughing cut: 1⅜" max. width, 0.200" depth. Finishing cut: 1⅜" max. width, 0.050" depth. Spindle speed: 385 RPM. Cutter: 8-flute carbide tip 3" dia. Table speed: 15 IPM—20 IPM. Stock removal: Approximately 4 cu. in. per min. Fixture: mechanical.

THE PROBLEM:

1. Fixture setup time and handling was 60 minutes plus time required to layout, drill and tap holes in the gibs to coincide precisely with the bolts of the fixture. Spacing varied between 9" and 10" at several intermediate increments.
2. The holes were not functional parts of the gibs, being used only to hold the gibs while being milled.
3. Because of the several milling operations, the gib had to be removed each time and re-bolted to the fixture.

THE SOLUTION: A Hanchett MAGNA-LOCK Magnetic Rectangular CHUCK positioned on a sine bar, the milling machine cutter spindle being swiveled to the corresponding angles.

THE RESULT:

1. FIXTURE SETUP AND HANDLING TIME—20 MINUTES.
2. Layout, drilling and tapping operations eliminated.
3. Time required to re-bolt gibs on fixture for each operation eliminated.

You, too, can increase your machines' productivity with Hanchett Magna-Lock Magnetic Chucks and Devices. Take advantage of Magna-Lock's experience and engineering know-how—at your service to help solve your holding problems. Magna-Lock is the only *exclusive* manufacturer of magnetic chucks and devices.

WRITE TODAY, Dept. GF-115.

Request Magna-Lock as original equipment on your new machines.

Magna-Lock

Hanchett **MAGNA-LOCK CORPORATION**

Magnetic Chucks and Devices

BIG RAPIDS, MICHIGAN, U.S.A.

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Machine Tool Guards Made Lighter and Stronger

A new improved method of producing all types of machine tool guards in the building of machine tools, such as grinder guards, gear guards and other machinery guards, are now being fabricated by a short-run process utilizing temporary tooling.

The originator of this process is Dayton Rogers Mfg. Co., 2824 13th Ave. S., Minneapolis 7, Minnesota. The guards are blanked and drawn to the desired size and shape, eliminating iron castings and weldments, thus reducing the finishing operation to a minimum when a high painted finish is required.

The small lot stamping technique is said to produce a much lighter and stronger guard than one made of steel. It is cheaper and requires fewer operations in the overall finishing. It lends itself to all machine tool and equipment assembly methods. •

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Horizontal Grinders for General Utility Work

Two new horizontal grinders, designed for all classes of grinding work, from accurate grinding using a tool post holder to heavier work using 4" or 6" organic wheels, are offered in five speeds.

Tools feature built-in muffler which has no external parts. Available with ⅜"-24 and ½"-13 spindle, both models can be completely disassembled without using any special tools.

Grinders are equipped with "C" Series air motors. Capacities range from 2½" x ½" organic wheel to 4" x ½" vitreous wheel on the ⅜"-24 spindle model, and from 2½" x 1" to 6" x ½" organic wheel on the ½"-13 spindle model. Tools can be adapted to use with wire brushes or roll abrasives. Buckeye Tools Corp., Div. 14, P.O. Box 966, Dayton 1, O. •

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Fluidmotion
GRINDING WHEEL DRESSERS

Forms wheels to shape easy as ABC

ON INTERNAL • CYLINDRICAL • SURFACE GRINDERS • TOOL AND CUTTER GRINDERS

This is the only radii and angle Wheel Dresser that will accomplish the form dressing of 2 angles, 2 radii and one flat tangent in one setting. It comes in several models to form dress wheels ranging from the smallest sizes to those of 24" in diameter.

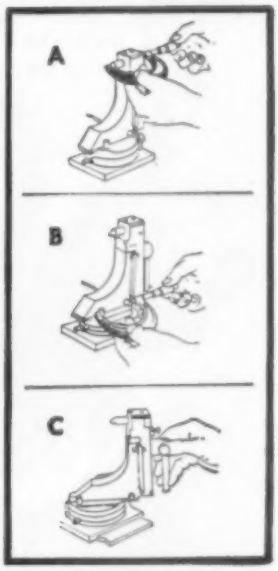
Fully adjustable, adaptable and semi-automatic in operation, the FLUID-MOTION Wheel Dresser is the only one requiring only a micrometer for setting to obtain any desired form.

Representatives in principal cities of the U.S.

A. *Measure over diamond point to back of micrometer plate.*

B. *Add required convex radius or subtract required concave radius.*

C. *Tighten gib. Dresser ready for action.*



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See your industrial distributor or write for free literature.

J&S TOOL CO. INC. — WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • DOWN-HOLDING DEVICES — CLAMPCUT • SINE BARS •

J & S TOOL CO., INC.
880 DORSA AVE.
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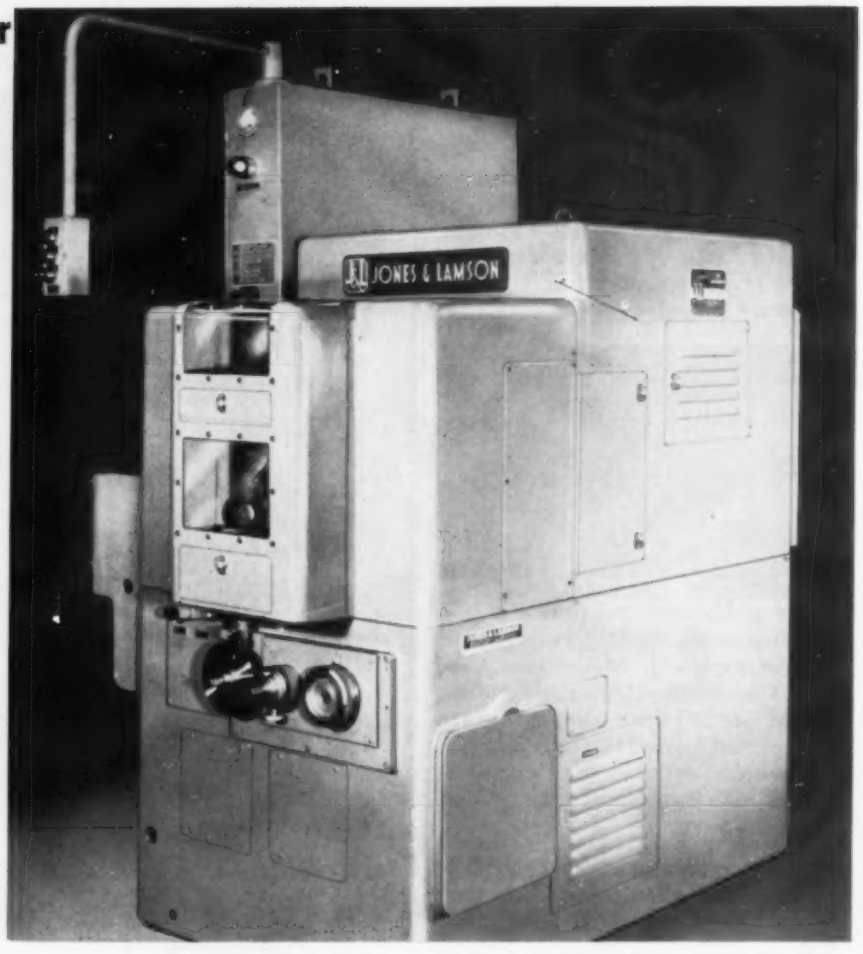
High Production Tap Grinder



Equipped with automatic work handling, this machine is designed for high production grinding of standard taps.

A wide range of work speeds are available specifically for effective grinding conditions on all tap sizes from 0 to ⅜-in. dia. Individual lead screws for each pitch have 1/3 the pitch of the thread being ground, insuring long lead screw life.

Grinding cycles are held constant and uniform as rapid wheel advance, depths of cut and rapid withdrawal are positively controlled through a simple cam action.

Wheel truing is automatic before or after a finish cut and is counter controlled when more than one piece is ground per dressing. Wheel sizes are 20-in., 18-in. or 16-in.

Work and wheel slides are mounted on anti-friction bearings with the wheel slide held against a positive stop with uniform hydraulic pressure for automatic, positive size control. The machine has provision for multiple cuts. Jones & Lamson Machine Co., 522 Clinton St., Springfield, Vt. •

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IT TAKES LESS TIME TO
MICRO-FINISH HARD MATERIALS WITH
ELGIN DIAMOND

Color Identified for Positive Use
Grades for Every Purpose
Use Any Standard Finishing, Polishing or Lapping Technique
Finish with diamond... Elgin Diamond!
Ready to Use, No Mixing

This booklet will help you Write for your free copy now!

See pictures of Elgin diamond in application ... gives details of method, grades to use and time required. Write today!

ABRASIVES DIVISION
ELGIN NATIONAL WATCH COMPANY
Dept. A-1
ELGIN, ILL.

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NEW! Push-Button
micro-precision flat lapping

SPITFIRE
GYRO-MATIC "21"
Lapping Machine

- *Automatic! Easy Push-Button operation!*
- *Super Precise! Produces optical flatness to .00001161*
- *Economical! Saves time, work, labor flat lapping any material!*

The new Gyro-Matic "21" means any firm . . . your firm . . . can now have finest finishing on any material! Cost is so low . . . performance so perfect . . . revolutionary advanced features so important—the Gyro-Matic "21" stands out as the most significant step forward in flat lapping in years!

18" and 24" flat lapping machines also available.

SPITFIRE ROLLER LAPPING MACHINES

Both upright and bench type models specially designed for micro-finishing cylinders, plug gages, shoulder parts, etc. in ⅓ the time!

Simulates figure 8 motion of hand lapping	*Simple-to-operate*	*Economically provides highest level quality control*

Write for complete detailed information *today!*

SPITFIRE Tool Co.
2937 N. Pulaski Chicago 41, Ill.

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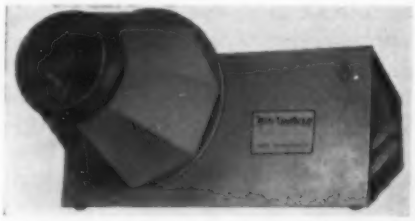
Small Bench Tumbler has One Gallon Volume

To round out its line of medium priced barrel finishers, Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, O., has announced its new Mini-Tumbler.



This is a small bench tumbler with one gallon volume barrel. Despite its small size this unit is sturdily built with heavy construction and parts to stand up under continuous operation on the tumbling of small parts in laboratories, foundries, plating shops, screw machine shops, lapidary shops and industry in general. It is claimed to turn out work at the same speed and of the same quality as larger tumblers, at a saving in production cost and factory space.

All barrels are vinyl-plastic coated, with either open or closed barrel. Power is furnished by a split-phase, 110 volt, 60 cycle, A.C. motor. Net weight is 25 pounds; color is green. The machine cabinet measures 16" long by 9" wide by 7¼" high, showing the small amount of bench space required.

Information is available on Mini-Tumbler or other sizes of barrel finishers up to 8 cu. ft. •

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New Holder For Safety Spectacles

A simply designed spring clip holds melter's safety spectacles or protective shields of clear or tinted plastic. Sold under the name of Kim-Clip it snaps in place on all types and makes of prescription lenses.

Adjustable to three definite positions, up, out, or down, Kim-Clip is light weight, convenient, practical and inexpensive. For those who wear prescription lenses they afford positive protection in welding and grinding operations and make ideal sun glasses for outdoor wear. Manufactured by Kimball Safety Products Co., 9310 Wade Park Ave., Cleveland 6, O. •

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82 Block Set
only $895
Accuracy ± .000008
solid chrome carbide
Reduced production costs—result of the installation of ultra modern specialized equipment brings this great saving.
Webber Croblox last many times longer than standard steel blocks. They lower production costs by insuring accuracy year after year. Corrosion resistant . . . extremely hard . . . permanently dependable. Order now, to insure prompt delivery.
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12911 TRISKETT ROAD
CLEVELAND 11, OHIO
LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

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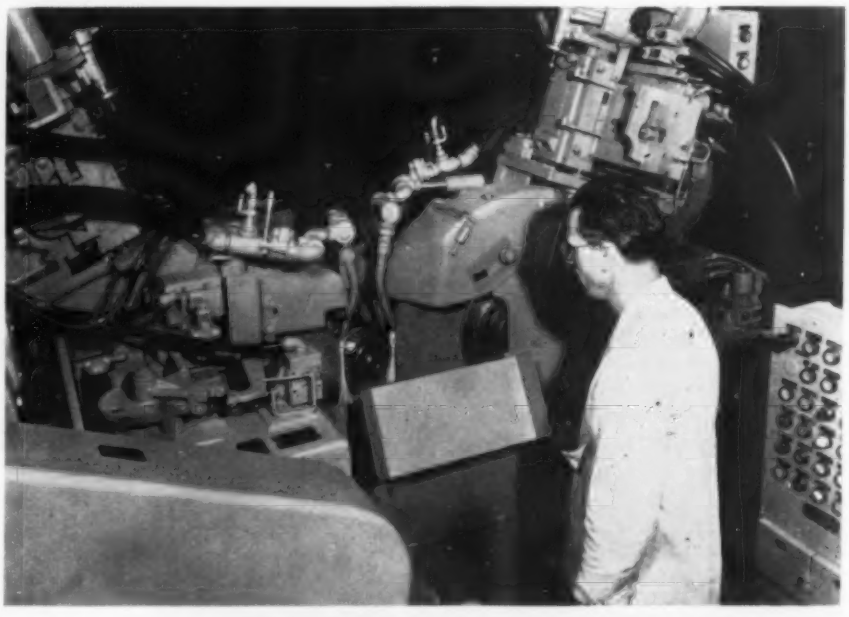
Semi-automatic Multiple Wheelslide Cylindrical Grinder

In its new type CMS-1 semiautomatic multi-wheelslide cylindrical grinding machine, Norton Co., Worcester 6, Mass., has brought out a special purpose grinder which can be adapted to a wide range of cylindrical grinding operations. The principle advantage of the machine is its ability to plunge grind multiple diameters simultaneously on workpieces which, because of their shape, do not lend themselves to grinding on conventional multi-wheel machines. Savings in both set-up and grinding time are substantial.

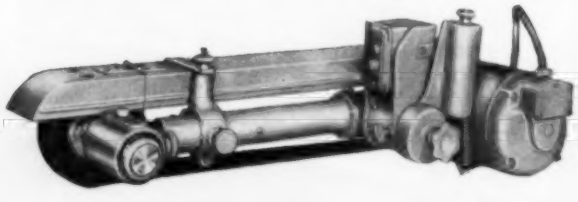
The machine has unitized wheel slides which are positioned during manufacture for the requirements of a specific job. The wheelslides may be opposed or placed in line, whichever is better suited. Provision is made for slight angular or lateral adjustment of position for set-up purposes. The slides are self contained with respect to motion and truing but operate in unison during production. Centrally located one-lever control of the automatic grinding cycle and automatic termination of the cycle under electrically timed control, simplify operation. Auxiliary independent control of the wheelslides is provided for setting up.

Each wheelslide mounts one or more 30″ diameter grinding wheels as the nature of the job requires. The type of work holding equipment furnished also depends on the job. Chucking arrangements on a single work head, or equipment for holding the work on centers, can be supplied.

Two-rate automatic feed assures availability of optimum conditions for rapid stock removal, workpiece accuracy, and finish. Convenient wheel feed hand wheels with click-count indexing mechanisms which permit feed adjustments in increments of tenths without visual attention, simplify size control in set-up and initial operation. Individual push-button operated jogging control of wheelslide movement aids production



THE G & P 6-72 BELT UNIT



Adaptable for almost every type of belt grinding and polishing

ADAPTABLE: 1. it is simple in design, lends itself to changes and elaborations; **2.** it has a capacity for finishing large and small pieces; **3.** can be used as both a primary or an auxiliary component of machines; **4.** it is a machine in its own right; **5.** it has mobility; and **6.** it can be used for off-hand finishing or mounted to obtain accurate dimensions. Write for Bulletin No. 104 for full details.

Makers of the famous MARSCHKE grinders and buffers.

Grinding and Polishing Machinery Corp.
SUCCESSORS TO VONNEGUT MOULDER CORPORATION
2530-B WINTHROP AVE., INDIANAPOLIS 5, INDIANA

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NOW... get Hartford's famous
TRIPLE ACTION
in fully enclosed cutting barrels

There's a new look in Hartford's Tumbling Barrels... but underneath you get the famous Triple Action Barrel originated by Hartford and unsurpassed for doing a better job ...faster... at lower cost.

Compare these advantages! The Hartford fully enclosed Model 1956 is extremely compact . . . requires less floor space than most enclosed barrels. With Hartford the power unit is on top, where it belongs for long life, cleanliness and ease of maintenance. Barrel is mounted on rugged "A" frame for maximum strength. Streamlined steel enclosure confines splash and contributes to safe operation. Pivoted front guard opens to permit quick, easy loading and unloading . . . plus easy removal of barrel assembly. Standard power unit has four speed gear shift transmission. Literature and prices promptly furnished.

Hartford
PRECISION BALLS • RETAINERS
BEARINGS • TUMBLING BARRELS

HARTFORD STEEL BALL CO., INC., 21 Jefferson, W. Hartford 6, Conn.

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by simplifying size control during regular operation. The increments of jogging control are adjustable and all wheelslide feeds occur with finest repetitive accuracy due to metal-to-metal contact of the revolving screw, wheel feed mechanisms.

Automatic wheel truing by wheel guard type devices assure efficient, effortless performance of the truing function. These devices provide the additional advantages of operating consistently at predetermined speed and feed. This reduces wheel cost per workpiece ground by making possible close, uniform control of the amount of abrasive removed from the wheels. Compensation of wheelslide setting for the amount of wheel diameter reduction after truing occurs automatically. •

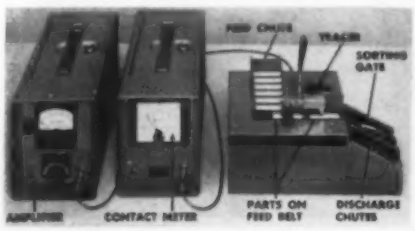
Use HANDY Postpaid Card. Encircle No. 122

Automatic Profilometer Equipment for Surface Roughness

Equipment that permits the addition of surface-roughness inspection to automated production setups has been designed to sort parts in accordance with the microinch roughness measured along an OD or flat surface, including tapers and parts with grooves or shoulders.

The work-pieces go from a feed chute onto a conveyor belt which moves them beneath a Profilometer tracer. As the parts leave the tracer, they are automatically directed into an accept or reject discharge chute in accordance with their roughness. With the equipment shown, the contact meter is set to the high roughness limit; and parts that are rough or rougher are rejected, while all other parts are accepted. Equipment can be furnished to accept work within a selected range of roughness, rejecting parts that are either too rough or too smooth.

Each application is engineered to the user's individual requirements, and the details vary accordingly. However, each installation for use with external surfaces includes the basic elements identified in the accompanying photo. In addition to the measuring-and-sorting equipment, the company can supply auxiliary items, including equipment for automatic selection of parts to be measured (such as every fifth or tenth part from the production line), signal lights, and controls to shut down the line after a given number of parts are rejected.



Additional information is given in bulletin LT16, available on request from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. •

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Precision Internal Grinding

The Grind-A-Matic is a new air-driven precision grinding head having a planetary action and is mounted as a tool in a jig bore, boring mill, lathe, drill press or other comparable machine tool. It offers advantages characteristic of the more expensive jig grinder. It is ideal for close tolerance toolroom work on dies and fixtures.

Fine adjustment of radial feed can be accurately made without interrupting spindle rotation.

Fine adjustment in increments of .0001 through a range of .084" is made by rotating a graduated collar which is spring-loaded to eliminate backlash. After setting, the collar position is locked.

Coarse adjustment from .084" to 1½" grinding radius is made with the spindle stationary. Thus with standard equipment holes from ⅛" to 2½" in diameter may be ground. With an auxiliary mounting arm the range is increased to 4".

The spindle is carried on high precision preloaded ball bearings, the balls of which are held to a tolerance of .00001" and the ways lapped.

Two interchangeable spindles are available, one developing speeds up to 12,000 rpm, the other having a maximum speed of 75,000 rpm.

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Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

MODERN Self Contained GRINDER-POLISHER

Hammond Variable Speed (1500 to 3000 RPM) Polishing and Buffing Lathe. Models up to 50 HP available.

Hammond Cyclone Duskolector. One of a wide line of Cyclone and Filter Types.

Hammond Backstands. 10 Air and Spring Tension Models to choose from.

Write for Catalog No. 60 showing America's most modern and complete line.

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1651 DOUGLAS AVENUE • KALAMAZOO, MICHIGAN

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INDIANAPOLIS, IVAN STRANGE, 33 Tyler Ave., Greenfield, Ind.
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CLIPPER DIAMOND TOOL CO., INC.
216 WEST 46 STREET, NEW YORK 36

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Production Unit Components

The two front and rear views of the four units in the photo were recently incorporated by a special machinery manufacturer in a continuous wire brushing and grinding operation.

The many variations of components consisting of slides, feeds, tables and super precision spindles, are said to permit most any user to develop his own production unit, whether it involves single or multiple attachments.

The upper illustration shows the assembly of a Super precision spindle with belted motor drive assembled as a unit on a vertical angle plate feed. Cylindrical reciprocation of the spindle is accomplished with an air or hydraulic cylinder assembled on a vertical angle plate equipped with composition (anti-friction ways).

The lower illustration is an assembly of a belted motor driven precision grinder with a spindle assembled on a vertical slide to permit positioning of the wheel on centers. The spindle housing, or bracket design allows for quick interchanging of spindles for the individual application.

Detailed engineering data sheets to permit design engineers incorporating similar units or a variable composite of units to complete engineering layouts are available from The Standard Electrical Tool Co., 2488-96 River Rd., Cincinnati 4, O. •

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New Packaged Type Dust Collector

The Green Fuel Economizer Co., Beacon, N.Y., manufacturer of the Aerodyne dust and fly ash collectors, draft and ventilating fans and other power and process plant equipment, is now marketing a packaged Aerodyne unit for use in industrial plants where dust control and removal are necessary.

Now! SAFER

Cut-off Machine Operation *with the New* BULLARD!

This outstanding machine is designed to give maximum safety . . . has many features:

- **Cutting Wheel Completely Enclosed**
- **Fast Production**
- **Economical Operation**
- **Close Work Tolerances**

Semi-automatic hydraulic operation is foot controlled, leaving both hands free.

Floor Space 24x42"

Write for circular and complete machine specifications TODAY!

BULLARD
Geo. H. Bullard
COMPANY INCORPORATED
HOPKINTON ROAD WESTBORO, MASSACHUSETTS
SPECIALTY MANUFACTURERS OF RESINOID BONDED HIGH SPEED GRINDING, CUT-OFF AND COPING WHEELS

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FREE TRIAL OFFER
NO STRINGS ATTACHED

A VALUABLE KIT
Carton contains 6 grades of ultra-fine quality, assorted fine grit abrasive compounds suitable for a variety of work. Coarser grit compound can also be supplied.

FOR PRECISION LAPPING

Here's a get-acquainted offer you cannot afford to miss. Among these samples will be found the answer to many a tool room lapping problem. Hard and soft abrasives for all kinds of lapping needs. Sent post paid anywhere in the U.S.A. and Canada.

OFFER LIMITED to those writing on company letterhead

No obligation—write today on your company letterhead.

PROVE THEM AT OUR EXPENSE!

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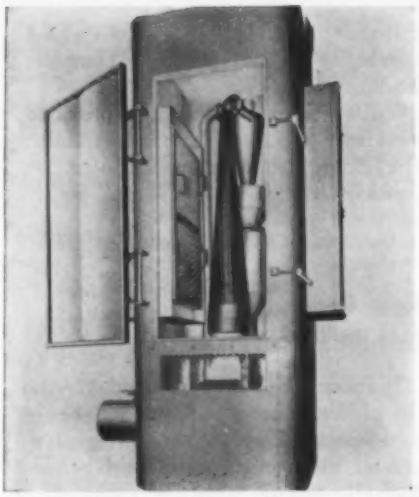

This unit is complete within itself consisting of the Aerodyne louvered cone and one or more fiber filter packs in series. The cone removes from the air or gas, coarser and medium particles: the filter packs remove the submicron particles and many of the undesirable condensable elements.

Classed as the type G. W. F. Aerodyne, this unit is available in capacities ranging from 1,000 to 10,000 cfm free air. Specifications are: 3'x3'x7' for the 1,000 cfm unit and 5'6"x5'6"x14' for the 10,000 cfm unit. Power requirements range from 1½ to 15 hp. with the motor assembled with the unit.

Tests indicate that for all practical purposes the unit will remove all solids and most condensable fumes. The dust free air can be used over again or vented to the atmosphere without danger of pollution. •

Use HANDY Postpaid Card. Encircle No. 126

Break Resistant Reinforced Wheels

Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill., is producing a break resistant reinforced grinding wheel known as the BR wheel.

The BR is a non-flexible type resinoid bonded reinforced wheel with three layers of glass fabric. This is said to give the wheel extraordinary strength without in any way impairing its rapid cutting ability.

In many instances these wheels are replacing heavy conventional type cup wheels used on portable grinders and are available in all types of portable grinder wheels including depressed center, cut-off and smaller snagging wheels.

From a standpoint of safety, efficiency and long life, they are claimed to represent a new development that means time and money savings in every shop, particularly where off-hand grinding is done.

The picture illustrates the wheel with the guard removed from the grinder so as to better picture the wheel. •

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WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use

$89.95

Illustrated Literature on Request

A few desirable distributor territories still available.

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WAGNER CONTACT ROLLER SPINDLE . . . ACTUALLY THREE SPINDLES IN ONE!

200,000 RPM MAXIMUM

- Specially suitable for carbide materials.
- Reduces grinding time.
- Makes lapping unnecessary.
- Low cost - Long life.
- In daily use at leading plants.

The Wagner Contact Roller Spindle has three pulleys which run in matched and selected ball bearings at speeds not exceeding 50,000 rpm, representing normal stress on precision bearings. By means of a planetary drive the grinding wheel speed is multiplied over the pulley speed by a ratio of 1 to 4, 1 to 5 or 1 to 6 depending on the specific application. Ideal for grinding small holes.

COLUMBIA INTERNATIONAL CORP. 10-35 44th Dr., Long Island City 1, N.Y. STillwell 4-1546

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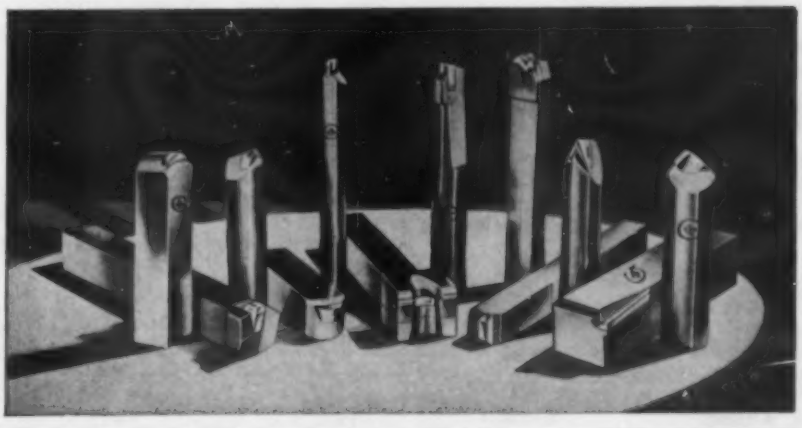

Diamonds for finish turning or boring plastics and non-ferrous metals. These tools are featured by quality diamonds with sharpest edges, combined with many years' experience in fitting them to perform efficiently on each operation.

Send for 36-page Illustrated Catalog No. 46

F. F. GILMORE & CO.

INDUSTRIAL DIAMONDS

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Grind-O-Flex Wheels in Larger Sizes

Merit Products, 4623 Irving Pl., Culver City, Calif., makers of the Grind-O-Flex wheel, now have in production two large 10" and 12" diameters in one- or two-inch widths. The larger wheels are designed for heavy duty light grinding, burr shagging, and polishing of flat or contoured surfaces; light for their size, they may be used on light equipment or in automatic set-ups.

Available in a full range of grits from No. 40 up to No. 320, they may be used in operations ranging from smoothing off flash to high polish operations. By the choice of the proper grit for the job, the required finish or light stock removal may be accomplished without danger of digging into

the workpiece or flatting radii. Several wheels may be "ganged" on one spindle to cover a broad surface, each wheel flexing individually to follow contours.

Carrying their own grit load, they never require re-gritting and give a uniform scratch for their entire life eliminating the necessity for frequent wheel changing or dressing.

Grind-O-Flex is a recent development; it consists of hundreds of leaves of aluminum oxide abrasive cloth sealed together at the hub, allowing complete flexibility.

Grind-O-Flex Wheels are provided with flanges to fit any threaded spindle. They may be quickly mounted on grinders, buffers, motor shafts, polishing jacks or automatics. •

Use HANDY Postpaid Card. Encircle No. 128

New Resinoid Grinding Wheel Bond

In its new B11 resinoid bond, Norton Co. of Worcester, Mass., has announced a significant step in the direction of greater uniformity of resinoid bonded grinding wheels from lot to lot. This new bond, used in conjunction with new molding and firing techniques, is said to insure a much more uniform structure than has previously been possible in resinoid wheels.

Increased uniformity of abrasive grain structure throughout the wheel is reflected in all-around improved performance. This means more accurate and uniform work, improved surface finish, reduced diamond truing tool costs as well as lower unit grinding costs.

With the increasing use of automated equipment, uniformity of grinding wheels from lot to lot is of prime importance. Changes in the automatic cycle need not be made to compensate for variations in grinding action. Even in manually operated equipment, the benefits of increased uniformity are important.

The improved uniformity of B11 resinoid bonded wheels insures better balance throughout the life of the wheel. This means better finish and better cutting action. This is particularly important on such precision operations as cam and roll grinding.

Resinoid wheels with the new B11 bond are available in a wide range of hardness grades and sizes. They have been tested successfully on almost all types of work using resinoid bonded wheels. These wheels are said to have been successfully applied to centerless, cam, roll, disc, and thread grinding operations in addition to snagging and surfacing. •

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Extension Makes Longer Radii Possible

A new wheel dresser extension for use with the J & S Form Master wheel dresser has been announced by J & S Tool Co., Inc., 87 Dorsa Ave., Livingston, N.J., manufacturers of the Fluid-motion line of precision grinding wheel dressers.

Using this new wheel dresser exten-

51% SAVINGS IN WHEEL COSTS!

(says a Midwestern foundry)

. . . SINCE WE INSTALLED STANDARD INFINITELY VARIABLE SPEED SNAGGING GRINDERS

Wheel Cost Per Ton of Castings Ground:

Before . . . $4.86

NOW . . . $2.38

SAVINGS . $2.48

ON EVERY TON OF CASTINGS GROUND!

+ INCREASED PRODUCTIVITY

+ BETTER "OPERATOR ATTITUDE"

Single and Twin Wheel Grinders 5 hp, 20" to 100 hp, 30" Wheels

Grinders...ALL KINDS!

the STANDARD FOUNDRY GRINDER DIVISION electrical tool co.

GRINDERS AND MACHINE TOOLS

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Write for Catalog and Complete Details

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sion, it is now claimed possible to make larger radii with the standard J & S Form Master angle and radius dresser. The concave radii range is increased from 7" on the standard dresser to 15" using the extension on a 7" wheel; the convex range with the extension is 12" instead of 4" without the extension on a 7" wheel. Very close tolerances are maintained.

Hardened and ground parts, sealed ball bearings and 100% dust-proof design provide a rugged and dependable tool for long service. As available in more costlier models, the Form Master dresses with the diamond point horizontal to the center of grinder spindle. Mehanite base permits drilling and tapping of holes when needed for quick set-ups on cylindrical grinders. Dimensions of base are 3" x 3".

The extension comes either as a complete assembly including the extension with the Form Master wheel dresser or as a separate attachment to the Form Master for those now in use. •

Use HANDY Postpaid Card. Encircle No. 130

New High-Speed Straightener and Polisher

A new Sutton straightener, known as Model 1½FX, has been developed to polish as it straightens bars and tubes at high production speeds.

In a typical application at Pilgrim Drawn Steel Div. of Automotive Materials Corp., the new machine straightens and polishes cold drawn steel bars from 5/16" to 2½" dia. at speeds up to 300 feet per minute. A variety of grades are straightened such as high and low carbons, Bessemer grades and alloys. Concentricity is controlled by the machine as it gives the finished bars a bright, smooth finish. Size tolerance can also be controlled by raising or lowering the diameter of the bar, depending on the analysis of the grade being straightened.

At the Pilgrim plant, the Sutton straightener is located at the end of a straight production line. It is tied in with a 50,000 pound draw bench capable of drawing bars triple, double or single, at various speeds. After drawing, the bars are conveyed to a pneumatic shear where they are cut to prescribed lengths. They are then fed to the straightener automatically.

In the machine design, a modification of the Sutton 5-roll principle of straightening is employed. The bars or tubes are fed through a horizontal pass line in which two large rolls are opposed by three smaller rolls. While normally only two of the five rolls are driven, the 1½FX Model has four driven rolls to provide a burnishing action which polishes as it straightens.

Power is provided by a 30/40 hp, 400/1600 rpm, 230 volt, adjustable-speed dc motor. All controls are readily accessible and change-over from one size to another is accomplished quickly. Anti-friction bearings are used throughout. Floor space is conserved by the top-mounting of motor.

Straighteners and polishers of similar design are available for other size ranges. For additional information, write Sutton Engineering Co., First National Bank Bldg., Pittsburgh 22, Pa. •

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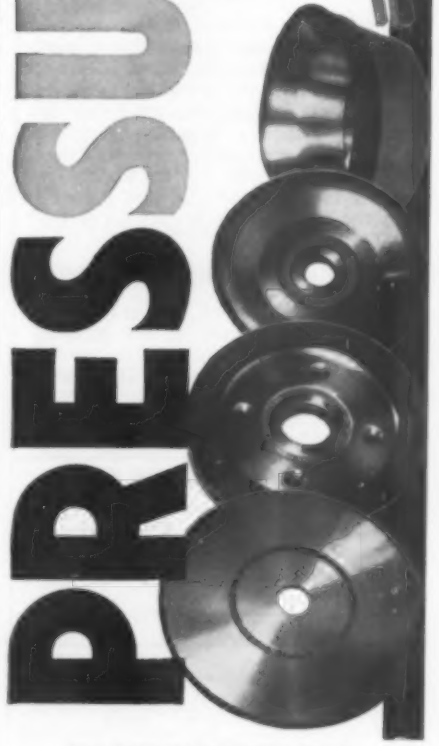
PRESSURELOK-224
RESINOID DIAMOND WHEELS
— the best diamond wheel bond ever developed —
if you've used them - you know they're best!
if you haven't - let us show you!
US
UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.



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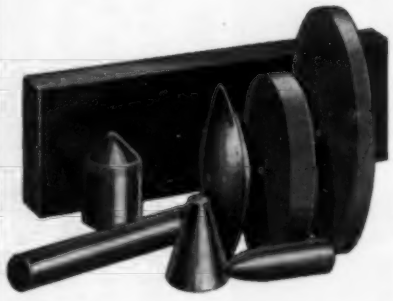
Reduce Labor Costs — Speed Production with

CRATEX

The World's Finest RUBBERIZED ABRASIVES

"cushioned action performance"



There are over 160 standard sizes and shapes of Cratex Rubberized Abrasives available to meet your needs in

BURRING, SMOOTHING and POLISHING operations

Manufactured in four "grit types" from coarse to extra fine, Cratex saves production and labor costs by doing one or more operations at one time—such as Cleaning, Blending, Lapping, Finishing, and Trimming—on hard or soft

METALS, PLASTICS, GLASS and scores of other materials.

CRATEX Rubberized Abrasives

Wheels, Points, Blocks, Sticks, Cones

—are ideal for manual or machine application—require no special equipment—always ready for instant use. For over 30 years, Cratex has served industry with unparalleled results—an unduplicated reputation for lowering "unit costs" in burring, smoothing and polishing operations. Investigate Cratex Rubberized Abrasives . . . "The World's Finest For Industrial Use" . . . send today for Descriptive Catalog which gives full details, applications and prices.

FREE CRATEX TECHNICAL SERVICE

Get the assistance of our abrasive engineers on your burring, smoothing and polishing problems. Merely check the coupon for "Application Analysis Form." This Cratex service will be helpful.

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☐ Descriptive Catalog.
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STREET

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Automatic Machine for Slicing and Dicing

Micromech Mfg. Corp., of 1020 Commerce Ave., Union, N. J., recently organized by the management of Sanford Manufacturing Corp., manufacturers of the Sanford Grinder line, has announced an entirely new and fully automatic machine for slicing and dicing Germanium, Silicon and Quartz.

The machine, known as Micro-Matic Precision Wafering Machine, is designed and manufactured specifically for use by the electronic industry in the processing of the above materials used in transistors and diodes manufacture.

It is equipped with control mechanisms and other automatic devices, together with inbuilt accuracy which will allow it to perform the functions of wafering and dicing semi-conductor materials.

The wafers produced are consistent in thickness, and parallelism is controlled to within several ten thousandths variation. Any predetermined thickness may be obtained, ranging from .010 to .225. A 4, 5, or 6 inch diamond impregnated metal saw may be used for slicing and dicing.

The working capacity of the machine is 6″ transverse, 12″ longitudinal, and up to 12″ vertical.

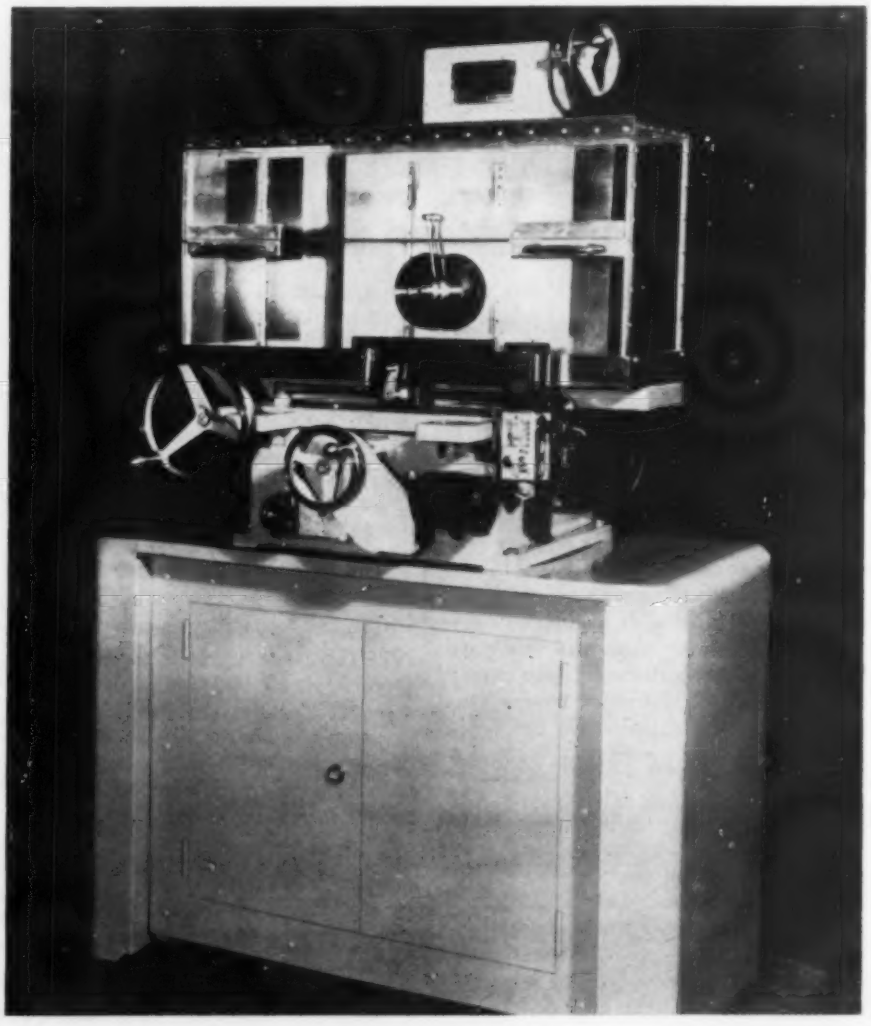
The machine is supplied complete with motors, controls, and other requisite mechanisms, together with stainless steel splash pan and lucite splash enclosure, coolant facilities, and an integral base housing the coolant tank and automatic control panel.

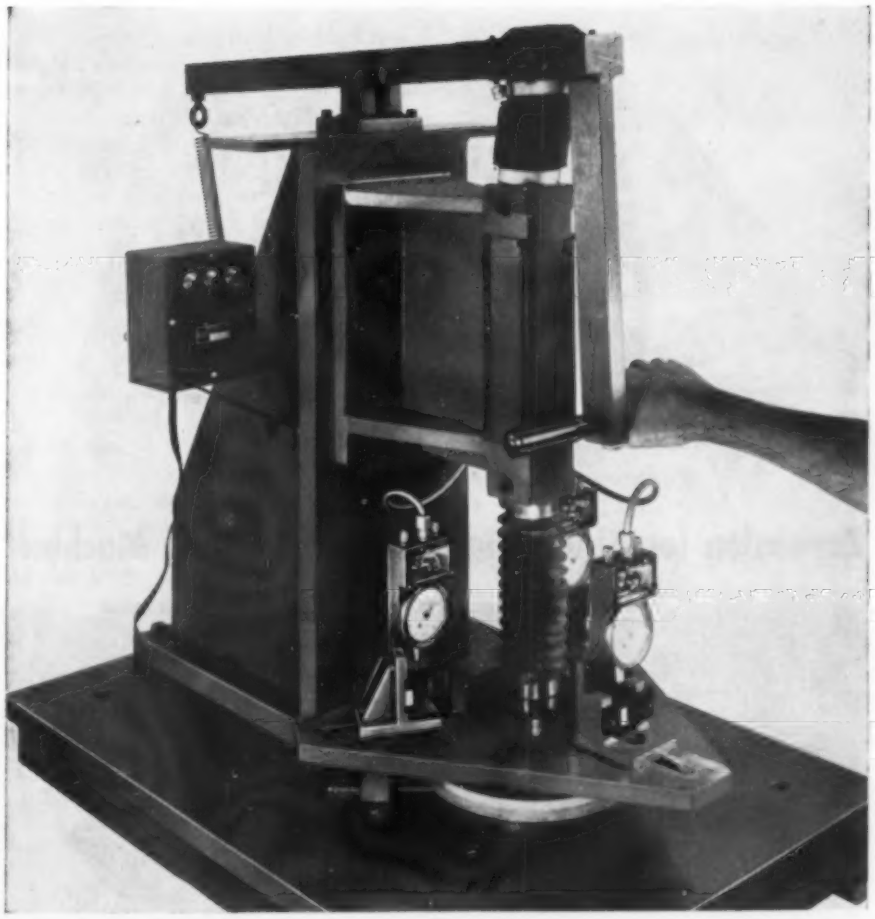
Two methods of operation are built into each machine:

Method A; Powered longitudinal table moves ingot toward and past saw, cutting first wafer; when cut is complete, crossfeed indexing occurs, the saw rotation and table direction are simultaneously reversed with second wafer being cut on return stroke. These actions repeating automatically until ingot is sliced complete, stopping for reload.

Method B; Ingot is fed as in Method "A", cutting first wafer, table direction is reversed (rapid return), saw passing between ingot and previous wafer, cross-feed indexing occurs and second wafer is cut. Actions repeating until ingot is completely sliced, and machine stops for reload of work. •

Use HANDY Postpaid Card. Encircle No. 132





Parallelism of Abrasive Grinding Wheels Checked by Adjustable Electric Gage

When grinding to the precise requirements of modern metal-working, precision is important in the grinding wheel. One condition that must be checked in order to assure a good cutting wheel is parallelism. If the side surfaces of the wheel are not parallel, the wheel will take uneven cuts, resulting in a large scrap pile. Also, at high speeds the wheel may wobble making accurate control difficult. Federal Products Corp., 1144 Eddy St., Providence, R. I. has designed and built a gage that measures this parallelism on several sizes of grinding wheels.

Three Federal Electricator gaging units are used to do the measuring. These are connected to an electric power unit which operates signal lights. The green light signifies all OK but if any of the Electricators find an out-of-tolerance condition other lights flash —red for high spots and yellow for low spots. Grinding wheels in the 6" to 12" diameter size range and from ½" to 2" in thickness can be accommodated on this particular gage, model 256 B-70.

To do the gaging, a grinding wheel is placed on three rest pads and against accurately located backstops. A triangular plate is then lowered on top of the grinding wheel. On this plate are the Electricators and both sets of contacts, reference and sensitive. When the gaging member is all the way down, all of the contacts seat on top of the workpiece. The sensitive contacts are mounted on frictionless motion transfer units which allow them to move up and down freely and it is this movement that transfers size variations to the Electricators. If the sensitive contacts are neither higher nor lower than the reference, within a specified tolerance, the green light flashes the OK signal—otherwise the appropriate off-tolerance light will be lit. The dials of the Electricators indicate the amount of error and location of the off-tolerance area which can be marked for rework.

The electric gaging units and the fast, easy to read signal lights enable an operator to check the parallelism of a grinding wheel very rapidly. The gaging speed is further increased by the simple method of positioning the work accurately on the gage. This type of gage can be designed for other sizes of grinding wheels or other products where parallelism is a critical factor. •

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NEW 22 BOND

BY "American"

OUTLASTS—
OUTPERFORMS
OTHER TOOLROOM WHEELS

Combines the cool cutting of open structure wheels with ability to hold size, even with deep, heavy cuts. Particularly adapted for toolroom operations using straight, dish, cup, or cylinder type wheels or segments. Also ideally suited for cylindrical or centerless grinding jobs.

BETTER BY TEST

Report from toolroom tests by a leading bearing manufacturer: An "AMERICAN" wheel (7 x ½ x 1¼) 77A60 HV-22 Aluminox took from .001 to .003 more down feed than the wheel regularly used on surfacing high speed as well as high carbon high chrome steel.

For a destruction test this wheel took a .050 cut on a piece of high speed steel 4 x 3 x 1½ with .010 to .015 hand cross feed and ground across the piece without burning.

Try this surprising new 22 Bond Wheel in your shop. Seeing is believing. Ask for descriptive folder . . . just mail the coupon today!

American Emery Wheel Works
Red Bridge, Providence 1, R. I.

Send folder describing your new 22 Bond Vitrified Wheel.

Your Name.....

Title.....

Company.....

Address.....

.....

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Expansion for Automation at Gear Grinding Machine

Photo shows portion of the recently-completed plant addition at the Gear Grinding Machine Co. providing a 33% increase in floor space. The highly modernized masonry and steel building will enable Gear Grinding to fill increasing orders for both screw machines and gear grinding machines.

Operator in foreground is turning the head spindle for one of Gear Grinding's automatic gear grinders.

Operator at the next lathe is machining experimental parts for a new model in the Detroit Screwmatic line. At far right is entrance to temperature-controlled inspection and jig boring room, where nine layout inspectors work with latest equipment, capable of measuring to one-half of a ten thousandth (of an inch).

Edgar D. Leon, president of Gear Grinding, said the total cost of completely equipping the addition for production of the new single spindle automatic screw machine will exceed $500,000.

O. S. Walker Co. Acquires Rawson Coupling

O.S. Walker Co., Inc., Worcester, Mass., has acquired the business of manufacturing and merchandising the Rawson Coupling, which for several years has been made and sold by the Washburn Shops at Worcester Polytechnic Institute. The personnel and manufacturing resources will be installed in the Rockdale Street Walker plant.

The Rawson Coupling is an auto-

matic centrifugal coupling which starts, couples, cushions and compensates for the load between the motor and various types of machines. It consists of two drum shaped members, one attached to the driving shaft and the other to the driven shaft. Between driving and driven members are inserted two sets of floating segments or shoes made of various materials, the total weight of the shoes being calculated to give the required horse power to carry the load.

The invention of the magnetic chuck by O. S. Walker sixty-eight years ago led to the formation of this highly successful company, which is a world leader in the manufacture of magnetic applications, including various types of chucks, lifting magnets and within the last year produced the largest permanent magnetic chucks in the world.

The newly acquired business will be carried on as The Rawson Coupling Division of the Walker Company.

Promotions at Houdaille-Hershey

J. D. Weatherford has been appointed western district sales manager for Houdaille-Hershey of Indiana, Inc. He will supervise sales for eleven western states with headquarters in Los Angeles.

Carl F. Holland has been appointed southern district sales manager and will supervise sales in 13 southern states plus Missouri, Kansas, Oklahoma and southern Illinois, with headquarters in Memphis, Tenn.

Whitnon Erects New Plant

A modern plant has just been erected in Farmington, Conn., near Hartford, as the new home of The Whitnon Mfg. Co.

William Giannone, president of the Whitnon firm, explained that "due to the increasing demand by industry of all types, it was necessary that we move to a more suitable location, and into a building that is in keeping with our far-reaching plans of expanded production of larger and more powerful spindles. With this change, we have tripled our area of operations and now are able to offer an even greater variety of precision spindles to industry."

The company, which moved to the new site from its 'birthplace' at New Britain, Conn., designs and builds spindles.

The new factory features suitability for heavier spindle-making machinery; a completely dust-free interior, air-conditioning; modern lighting; and a re-inforced cement foundation.

Within its new home, the 9-year old company will be expanding on a production program which includes the output of spindles for internal and external grinding, gear and thread grinding, tool and cutter grinding, surface grinding, high-speed drilling and milling, engravers and duplicators, diamond boring, plus high-cycle and other special applications requiring precision revolving machinery. The spindle makers sell to the synthetic, textile, plastic, glass and woodworking industry, and also report a steady business with aircraft industries involved in national defense.

"Along with our physical operations," states Mr. Giannone, the Company President, "we are also expanding our free and professional consultation service which has been praised by hundreds of clients and prospects."

In addition to Mr. Giannone, other Whitnon officials include Robert B. Darlington, of Easton, Vice-President; Herbert Weaver, of Farmington, Secretary; and Harry Giannone, also of Farmington, Treasurer.

Permattach Diamond Tool Co., Inc., Milford, N.H., has announced the appointment of **Thomas W. Eastwood** as general sales manager. Mr. Eastwood was previously associated with Austin-Hastings Co., Cambridge, Mass.

Mr. James A. Turnispeed, Jr. of Birmingham, Ala. has been appointed an abrasive engineer for North Carolina, South Carolina, Tennessee, Northern Alabama and Eastern Arkansas for Bay State Abrasive Products Co., Westboro, Mass.

Prior to this appointment Mr. Turnipseed was an abrasive engineer for the Sterling Grinding Wheel Co., Tiffin, Ohio.

J. D. Weatherford

Carl F. Holland

James A. Turnipseed, Jr.

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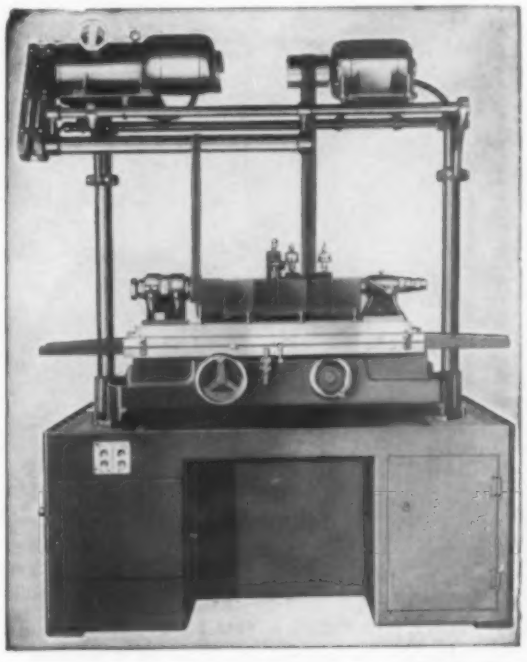
WHY AN OVERHEAD DRIVE?

When purchasing a Grinder you want roundness from .000005 to .000020, a finish from One to Five R.M.S. with immediate spark-out for fast production and ability to hold size from .0001 to .000010.

In order to accomplish this CRYSTAL LAKE uses double taper cone bearings that are pulled into solid bronze boxes.

CRYSTAL LAKE introduced their One R.M.S. Grinder in 1936 featuring their separate motor drive, eliminating cine-wave and providing ample power as a motor larger than wheel head can be used. To produce a One R.M.S. a heavy oil drag has to be placed on bearings. When a spindle is round and held tight in solid boxes, sizing is easy. Spindle, if necessary, can be stopped for measuring of small work, as motor recoil is taken up by springs on hinged motor plate.



As an example of the advantages of the overhead drive, we use our No. 1018 Universal Grinder which is equipped with a 2 horse power motor mounted overhead driving the wheel head spindle ninety degrees from grinding wheel pressure which keeps the bearings round and doubles their life. A one horse power drag is placed on a 2⅛" Diameter spindle so wheel will have to cut round. Bearings can be adjusted from time to time by using Dial Indicator to set end play.

Along with the two horse power on the Wheel Spindle a ¾ h.p. Speedranger is used on the Headstock so a ⅓ h.p. drag can be placed on double taper headstock bearings. Headstock will grind round from .000005" up.

Table can be moved easily as several hundred pounds are taken off table by this mounting.

Write for literature

CRYSTAL LAKE GRINDERS

Since 1910

CRYSTAL LAKE, ILLINOIS

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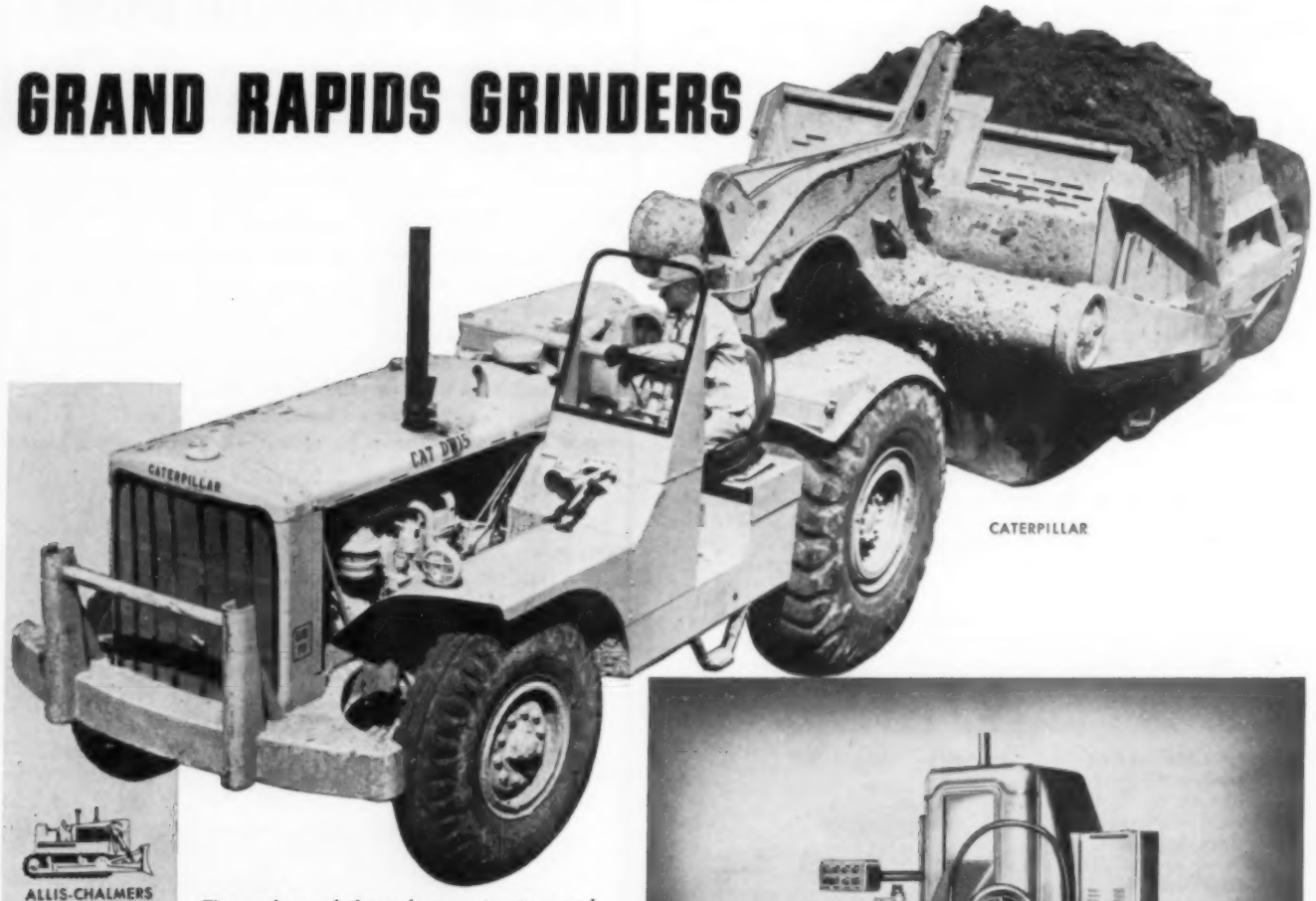
FOUND WHERE WORLD FAMOUS TRACTORS ARE "BORN"

GRAND RAPIDS GRINDERS



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INTERNATIONAL HARVESTER

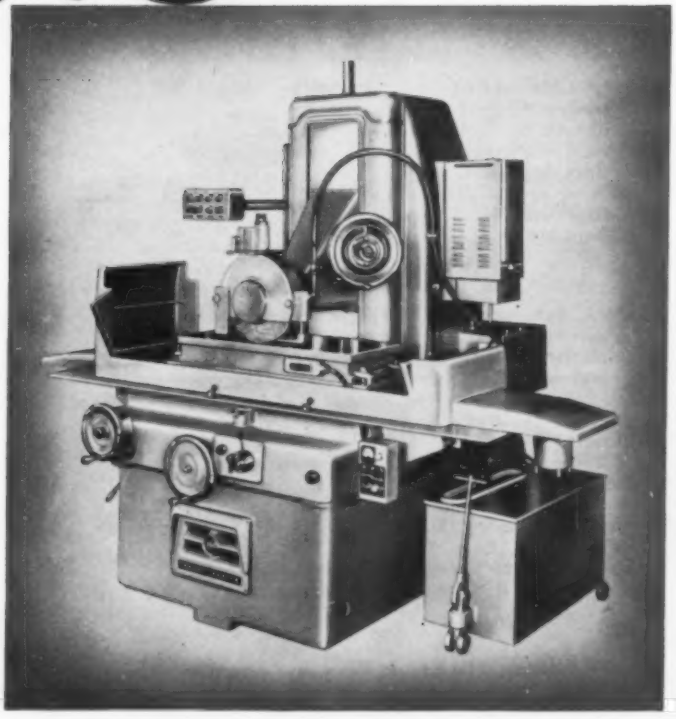
R. G. LeTOURNEAU

MASSEY-HARRIS-FERGUSON

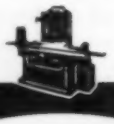
The makers of these famous tractors and allied heavy-duty equipment use Grand Rapids Grinders in their toolrooms. In fact, you'll find Grand Rapids Grinders wherever manufacturers place a premium on precision . . . because they're designed and built for lifetime precision grinding.

Take our Model 560, shown at right. Its column and base are a massive, one-piece casting for permanent, rigid alignment. Wheel head has powered rapid vertical travel; cross feed and longitudinal travel table are hydraulically actuated. Table speed is variable up to 140 fpm, making this the *fastest* grinder of its type and size!

If you're not already enjoying these standout features in your toolroom, a note on your letterhead will bring full details.



GRAND RAPIDS No. 560 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 140 fpm. Working surface of table is 14" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1800 and 2140 rpm.



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GALLMEYER & LIVINGSTON CO. 416 STRAIGHT AVE., S.W. GRAND RAPIDS, MICHIGAN

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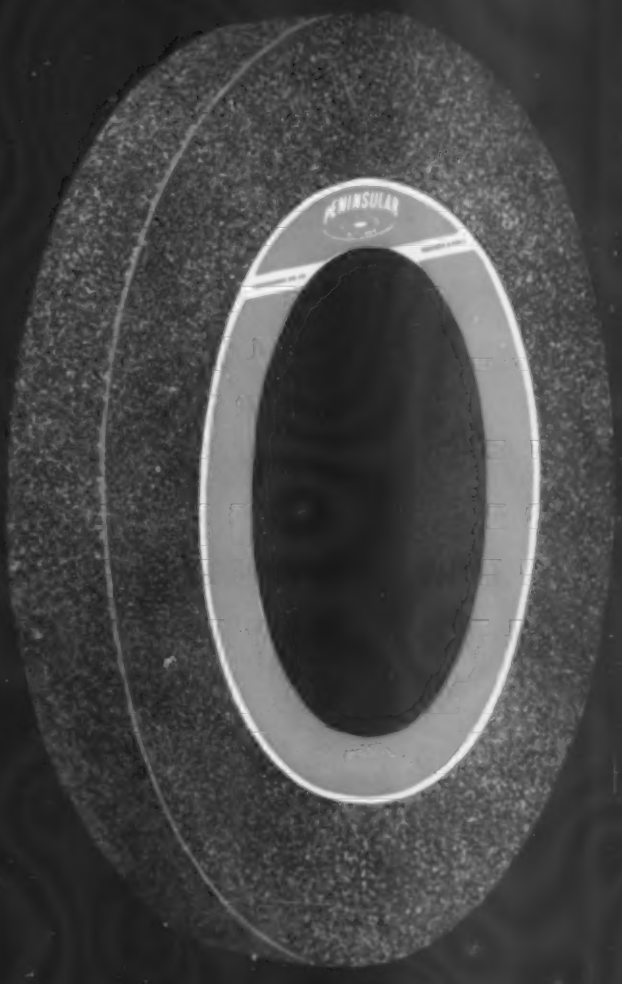
there's no Lagging to your Snagging

with Peninsular Resinoid Grinding Wheels



Specify Peninsular Resinoid Grinding Wheels for faster, easier, more economical casting cleaning and billet grinding jobs. These superior grinding wheels have been created by technicians devoted solely to the production of better abrasive units for foundries and steel mills. They are manufactured in the Meldrum Avenue Plant, which is concerned only with Peninsular's resinoid wheel production. Behind them is sixty-six years steady progress in the making of better quality.

Where your job is especially rough and tough, Peninsular resinoid Grinding Wheels are the natural choice for lowering operator fatigue . . raising production curves!

Your inquiry will receive every attention from our experienced abrasive engineers. Write or wire us today, asking for Peninsular's new Catalog No. 5E, which gives complete data on vitrified and resinoid products.

PENINSULAR SINCE 1889

THE PENINSULAR GRINDING WHEEL DIVISION

• • •

of **ABRASIVE AND METAL PRODUCTS CO.**

729 MELDRUM AVENUE, DETROIT 7, MICHIGAN

A&MP COMPANY

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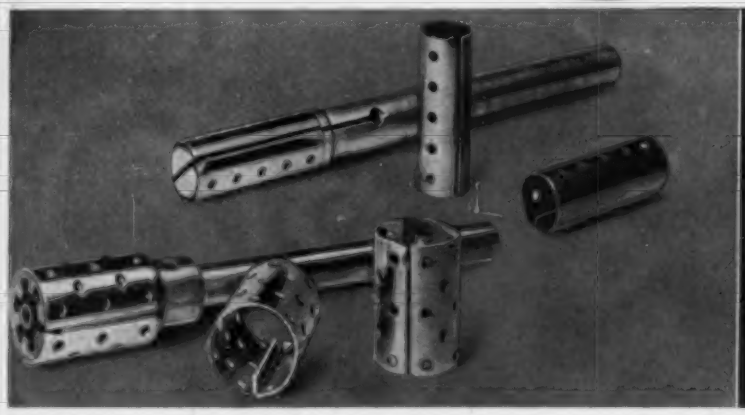
Engineered for Industry... **3 COMPLETE LINES OF ABRASIVE GRAIN**



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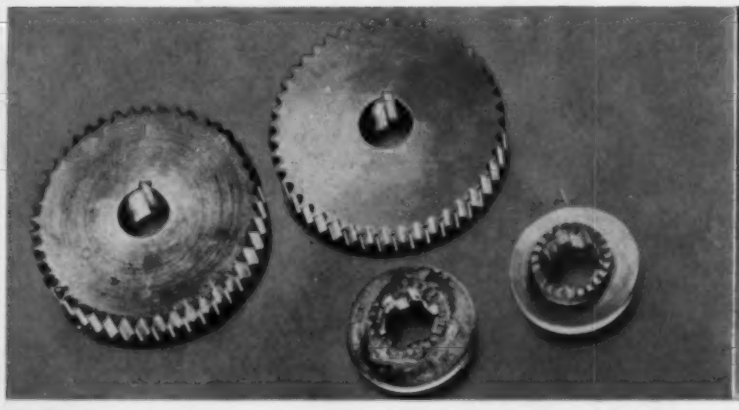

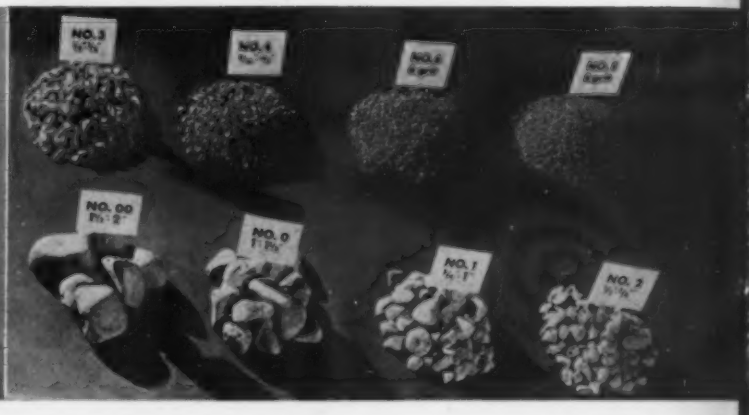

2 For Deburring and Polishing small parts... **TUMBLING GRAIN AND NUGGETS**

3 For every type of Metal Polishing and Buffing... **POLISHING GRAIN AND POWDER**

As the world's largest producer of crude and manufactured abrasive grains, CARBORUNDUM offers you three complete lines of grains, powders, and finishing compounds for metal polishing. Each type of grain is expertly *engineered* with as much skill and care as any production tool, to perform a specific job better, faster... at lower cost.

FREE BOOKLETS! To help you identify, select and use the proper abrasive grain and powders, ask for Booklet 14. For up-to-date information on lapping and finishing operations, ask for Booklet 13. Both are illustrated, give specific recommendations for use. Write The Carborundum Company, Dept. GF 83-52, Niagara Falls, New York.

CALL YOUR CARBORUNDUM DISTRIBUTOR or salesman (listed in the yellow pages of your phone book under "Abrasives" or "Grinding Wheels"). He's qualified to give you expert counsel on any polishing problem... and he's completely stocked to give you prompt service on your requirements.

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...continually putting more **SENSE** *in your abrasive* **DOLLAR**

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